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THE MOLLUSCA COLLECTED BY THE UNIVERSITY OF MICHIGAN–WILLIAMSON EXPEDITION IN VENEZUELA

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PART VI

THIS paper is the last of a sequence of studies on the land and fresh-water mollusks of Venezuela; those previously published are: Parts I (Curaçao) and II (Venezuela), paper no. 137 of this series (1923); part III, no. 156 (1925); part IV, no. 167 (1926); and part V, no. 182 (1927). The present part deals especially with the fresh-water forms; the arrangement and treatment are the same as those outlined in the forewords of parts III–V. It also includes notes on a collection of shells obtained by a University of Michigan Expedition from near Dunoon, British Guiana. In addition, a number of addenda and errata for the preceding parts and an outline of Venezuelan localities are appended.

In the following pages an asterisk (*) indicates that the species or subspecies so marked are not known to occur in Venezuela. The abbreviation A.N.S.P. stands for Academy of Natural Sciences of Philadelphia.

AMPULLARIIDÆ

I use the family name Ampullariidæ, instead of one founded on *Pila* Roeding, because, in the first place, I do not consider

the Museum Boltenianum proper basis for scientific nomenclature (despite its tentative sanction by the International Commission), and, in the second place, we have no proof that this sales-catalog appeared prior to Lamarck's paper (June or July, 1799). The title-page of the Museum Boltenianum is not dated (photographic reproduction) and the "publication" of the catalog, without lapse of several months after the penning of the introductory letters (September, 1798), appears extremely dubious, especially when one considers conditions in Germany at that time.

Pomacea urceus (Müller)

Nerita urceus Müll. (1774, Hist. Verm. II, p. 174), in Insulis Indiae edulis. *Ampullaria urceus* Philippi (1851, Chemn., p. 54, pl. 17, fig. 1), Guiana; Reeve (1856, Conch. Icon., pl. 4, fig. 18), Trinidad; Mart. (1873, Fest. Ges. Nat. Fr. Berlin, p. 201), swamps near Rio Yaracuy, Ven.; S. Catalina, Orinoco; Vanatta (1915, Naut. 29, p. 83), Rio Vagre, Ven.

Pila manetou Röding (1798?, p. 145).

!A. oblonga Swainson (1822, Zool. III, 3, pl. 136, middle figs.), habitat unknown; Ph. (1851, p. 21, pars, pl. 10, fig. 1); Rve. (1856, pl. 15, fig. 70). *?A. oblonga* Ph. (1851, p. 21, pl. 5, fig. 6), Caripe; Mart. (1873, p. 202), Rio Orinoco; Alderson (1925, Ampull., p. 48, pl. 11, fig. 2).

A. dolium Ph. (1851, p. 40, pl. 11, fig. 1), Guiana, "namentlich der Orinoco."

Dead shells along creeks at Miranda, Palma Sola, and Tucacas (H, VIII, b, 16, 22, 30). A.N.S.P. (from Venezuela): 50562 (R. Swift), Carácas; 50563 (Tate), Upata, Caratal; 50566 (Henyer), Rio Yaracuy; 50666 (Swift Collection), Aragua de Barcelona; 50667 (Swift Coll.), Orinoco; 85329 (H. Ward), back of Puerto Cabello; 105218 (Bond Exp.), Rio Vagre; 120206 (Wheatley Coll.), Barcelona; 120207 (Wheatley Coll.), Rio de Neveri, prov. Barcelona.

The original figure of Swainson's *A. oblonga* undoubtedly represents a young specimen of *P. urceus;* it is matched almost exactly, with intermediates, by shells in the Academy of Natural Sciences of Philadelphia. Philippi's new figure of *A. oblonga,* from Caripe, and Martens' records may refer to some species of the *Limnopomus* group, related to *P. interrupta* (Swby.).

Pomacea nobilis (Reeve)

A. nobilis Rve. (1856, pl. 2, fig. 8), Rio Marañon (eastern Peru).

A.N.S.P. 120276: a single specimen labeled as from the Orinoco (Wheatley Coll.).

This Venezuelan specimen is smaller, with a narrower umbilicus, and lacks the reddish tinge of the peristome, but it approaches so closely to topotypes of *P. nobilis* (A.N.S.P. 50683) that I have no doubt it is the same thing. The locality may possibly be erroneous.

Dimensions

	Shell		Aperture		Whorls
	altitude	maj.diam.	altitude	diameter	
Reeve, pl. 2, fig. 8..	107.5	90(96.3)	77(82.3)	70(57.3)	
A.N.S.P. 120276...	88.8	85(75.5)	75(66.5)	70(46.7)	5¼

Pomacea papyracea (Spix)

A. papyracea Spix (1827, Test. Braz., p. 3, pl. 4, figs. 1, 2), northern Brazil; Mart. (1873, p. 202), Venezuela.

**Pomacea swainsoni swainsoni* (Philippi)

A. fasciata var. Swainson (1831–2, Zool. Ill., series 2, vol. 2, *Ampullaria* pl. 3), Demerara, British Guiana. *A. swainsoni* Ph. (1851, p. 53, pl. 16, fig. 5), habitat unknown (*sic*); not of Hanley (1854–8, Conch. Misc., *Ampullaria*, pl. 1, fig. 1), and probably not that of Sowerby (1909, Proc. Mal. Soc. London 8, p. 358), La Plata.

A. lineata, pars Swby. (1909, p. 354), British Guiana.

According to Swainson, his specimen came from Demerara; apparently, Philippi had no examples as he founded his name on Swainson's figure, but ascribed it to his usual habitat for Ampullariidæ. It may be a synonym of *Helix lineata* Spix (1827, Test. Fluv., pl. 5, fig. 2), from Brazil, as suggested by Sowerby, but the shells from Guiana seem to have a shorter spire (usually shorter than in Swainson's figure), and should be kept separate until the ranges of the two forms are shown to be continuous. This species is superficially similar to *P.*

chemnitzii (see below) in form, but has the impressed, subcanaliculate suture so characteristic of most species from the Amazon drainage basin and southward.

Pomacea swainsoni metcalfei (Reeve)

A. metcalfei Rve. (1856, pl. 25, fig. 119), habitat unknown; Vanatta (1915, p. 83), Manimo River, Ven.

A.N.S.P. 50543 (R. Tate), Venezuela; 50544 (Swift Coll.), Venezuela; 105223 (Bond Exp.), La Buelta Triste, Rio Manamo, Ven.

One of the shells in lot 50544 is heavier and approaches very closely Reeve's figure. Most of the remainder are thin and fragile, with much more rapidly increasing whorls, which result in an enormously expanded aperture. On the basis of most of this material, it would appear to be very distinct, but lot 105223 contains both the patulous form and shells which are not distinguishable from some specimens of true *swainsoni* (Guiana), together with a good series of intermediates.

	Dimensions				
Sw. (pl. 3), *swainsoni*	71.9	80(57.9)	73(52.3)	73(38.0)	
Reeve (pl. 25, fig. 119)	53.0	83(43.8)	78(41.6)	68(28.3)	
A.N.S.P. 50543					
One adult.....	46.2	91(41.2)	82(37.2)	75(27.9)	4¾
A.N.S.P. 50544					
Two adults.....	57.6	73(42.3)	68(39.4)	74(29.2)	4¾
	62.3	82(51.0)	77(47.9)	66(31.8)	5¼
A.N.S.P. 105223					
Means, 10 adults..	58.4	83(48.6)	79(46.5)	71(33.2)	5
Minima, 10 adults	42.3	80(35.7)	76(34.3)	68(24.8)	dec.
Maxima, 10 adults	69.4	88(57.3)	88(57.6)	78(40.5)	dec.

Pomacea avellana (Sowerby)

A. avellana Swby. (1909, p. 360, text fig.), Lagunella, Ven. (Lagunillas, Estado Merida?); Kobelt (1913, Chemn., p. 190, pl. 68, figs. 7, 8); Alderson (1925, p. 23, pl. 7, fig. 6).

?A.N.S.P. 8193 (Swift Coll.), near Puerto Cabello.

The original type seems to have been a heavy, somewhat deformed shell, but the immature specimen in the Academy of Natural Sciences of Philadelphia approaches the figures of Kobelt and Alderson. This species appears to be closest to *P. swainsoni,* but is much smaller.

Pomacea chemnitzii (Philippi)

?Pila periscelis Röding (p. 146), citation of the famous "cordon bleu" of d'Argenville (Conch., pl. 17, fig. B), a quite unrecognizable figure.

A. fasciata Lam. (1816, Encycl. Meth., pl. 457, figs. 3), habitat unknown; not of Roissy (1805, Hist. Nat. Moll. 5, p. 374), type locality Jamaica.

A. chemnitzii Ph. (1851, p. 39, pl. 10, fig. 9), habitat unknown (slightly immature shell); not of Drouet (1859, Moll. Guy. Fr., p. 80, pl. 4, fig. 47.)

A. porphyrostoma Rve. (1856, pl. 6, fig. 30), habitat unknown; Kobelt (1912, p. 115, pl. 44, figs. 6, 7, pl. 46, fig. 5), New Granada; Alderson (1925, p. 41, pl. 10, fig. 1), Colombia, Ecuador. *A. hopetonensis porphyrostoma* Swby. (1909, p. 353), New Granada.

A. scholvieni Kobelt (1914, p. 223, pl. 77, figs. 6, 7), Puerto Cabello, Ven.

A. columbiensis Vanatta (1915, p. 83), Rio Manimo, Ven.; not of Philippi.

Dead shells common along shores of a large, *Pistia*-choked lagoon, 4.5 kilometers south along railway from Tucacas (H, XI, 30), now chosen as type locality. A very large shell from Caño Minapam, near Palma Sola (H, VIII, b, 20). A.N.S.P. 50564 (Swift Coll.), Puerto Cabello; 105222 (Bond Exp.), Rio Manamo, Ven. (young).

My shells from Tucacas are of exactly the same form as that in Philippi's figure, which represents the type of his species. Although the shells are fresh and the olive-green epidermis is mainly preserved, the shell color is the same ashy blue as that shown by Philippi. Even the adult shells are thin and fragile, with the peristome only slightly thickened. A specimen in the A.N.S.P. (120419, from Colombia) is heavier and darker in color and thus approaches Reeve's figure of *porphyrostoma,*

which I believe to be simply a form of this species. The Palma Sola shell is still larger and heavier. *P. chemnitzii* is certainly a member of the *reflexa-flagellata-paludosa* group, as suggested by Sowerby (for *porphyrostoma*), but it seems sufficiently distinct to allow it specific rank. Lamarck's original *A. fasciata*, not his complex assemblage of later date, is probably also this species, but the name had already been used by Roissy for a Jamaican shell (Cf. Pilsbry: 1927, Proc. A.N.S.P. 79, p. 247). I can see no tangible characters for the separation of *A. scholvieni* from this species.

	Dimensions				
Philippi (pl. 10, fig. 9)..	44.4	84(36.8)	72(31.4)	67(21.1)	6(?)
Rve. (pl. 6, fig. 30)....	57.5	86(49.4)	71(40.6)	53(30.4)	
A. scholvieni Kobelt....	44	84(37)	68(30)	60(18)	5½
H, XI, 30					
Means, 7 adults.....	46.7	82(38.4)	68(31.8)	71(22.6)	5.4
Minima, 7 adults.....	39.8	79(32.7)	65(27.3)	67(19.3)	5
Maxima, 7 adults.....	52.2	85(43.0)	70(36.4)	74(26.7)	5½
H, VIII, b, 20					
One adult.....	72.8	85(61.9)	71(51.6)	72(37.3)	6
A.N.S.P. 50564					
One adult.....	54.7	80(43.9)	71(38.8)	74(28.6)	5¾

Pomacea eximia (Dunker)

A. eximia Dkr. (1853, Zeit. Mal., p. 93), Prov. Coro, on Lago de Maracaibo, Ven.; Mart. (1873, p. 202). *A. cassidiformi* Rve. (1856, pl. 12, fig. 56), Lago de Maracaibo.

Dead shells along a caño at El Guayabo (H, VIII, b, 45) and in swamps just behind banks of Rio Catatumbo at Encontrados (H, X, XII, 46), where the adjacent lowlands are lower than the natural ramparts of the river. A.N.S.P. 50549 (Phillips), Lago de Maracaibo; 50674 (W. G. Binney), Maracaibo (very small); 59684 (Swift Coll.), Punta Palmas, L. Maracaibo; 120209 (Wheatley Coll.), Rio Catatumbo; 120229, Rio Catatumbo.

On account of its association with the Lago de Maracaibo, some writers seem to have developed the idea that this species may live in salt water. As a matter of fact, the Lago is an extensive but shallow body of water, which, on account of its narrow and very shallow outlet, is comparable to the tide-waters of a large river rather than to an arm of the sea. The water in its southern end is always fresh, while even at Maracaibo (according to the inhabitants) it varies from distinctly salt during the dry season (the time of my visit) to almost fresh during the wet period.

	Dimensions				
Dunker (text)	113.8	71(80.3)			5–6
Reeve (pl. 12, fig. 56)..	90.2	78(70.7)	76(68.3)	65(44.6)	
H, VIII, b, 45					
Means, 5 adults.....	78.4	84(65.8)	74(58.0)	71(41.4)	dec.
Minima, 5 adults	70.0	82(59.3)	72(51.5)	67(35.9)	dec.
Maxima, 5 adults....	92.0	85(75.1)	75(69.1)	74(48.8)	dec.
H, X, XII, 46					
Means, 8 adults.....	74.8	83(62.6)	76(56.5)	69(39.3)	dec.
Minima, 8 adults....	65.8	81(54.7)	73(48.7)	66(34.6)	dec.
Maxima, 8 adults....	91.6	86(78.4)	81(71.7)	71(48.3)	dec.
A.N.S.P.					
Means, 8 adults.....	80.9	79(64.1)	75(60.7)	66(39.8)	dec.
Minima, 8 adults....	51.1	76(41.7)	72(38.1)	62(24.4)	dec.
Maxima, 8 adults....	106.6	82(82.7)	78(78.8)	71(49.5)	dec.

Pomacea vexillum (Reeve)

A. puncticulata Reeve (1856, pl. 4, fig. 19), locality unknown; not Swainson 1822, pl. 143, middle figs.); Swby. (1909, p. 356), Cayenne; Kobelt (1913, p. 179, pl. 64, figs. 5, 6. pl. 67, figs. 7, 8), Cayenne.

A. vexillum Rve. (1856, pl. 4, fig. 20) locality unknown.

A.N.S.P. 120233 (Wheatley Coll.), one specimen from Venezuela.

Reeve's *puncticulata* and his *vexillum*, as indicated by Sowerby, are probably the same species, although the type of the latter has a peculiarly formed peristome. However, the

A. puncticulata of Swainson agrees only in color and sculpture; its form is very different and its peristome, according to Swainson, has the internal shelf that is characteristic of true *Ampullaria.*

	Dimensions			
Reeve (pl. 4, fig. 19)	55.1	76(42.2)	70(38.4)	68(26.1)
Reeve (pl. 4, fig. 20)	56.0	78(43.6)	77(43.1)	68(29.4)
A.N.S.P. 120233	56.8	81(46.3)	76(43.3)	63(27.1)

Pomacea (*Limnopomus?*) *pertusa* (Sowerby)

A. pertusa Swby. (1894, Proc. Mal. Soc. 2, p. 48, pl. 4, fig. 23); Swby. (1909, p. 355), Merida, Ven.; Alderson (1925, p. 55, pl. 11, figs. 9, 10); (?)Kobelt (1913, p. 168, pl. 62, figs. 1, 2), Merida.

?A.N.S.P. no. 8190, without locality.

I am quite unable to understand this species. Sowerby originally described it from an old specimen without locality and compared it to his *A. castelloi,* which is similar to the *Limnopomus* group. Alderson's figures uphold this relationship, but Kobelt's (of a specimen sent him by Sowerby) represent something near *P. vexillum,* with sculpture approaching *P. urceus.* The shell in the A.N.S.P. seems close to Kobelt's figure. Some one should refigure the actual type.

	Dimensions				
Sowerby	68	75(52)	74(43)	58(25)?	5
Kobelt	58	83(48)			5½
A.N.S.P. 8190	61.8	77(47.9)	71(43.9)	71(31.3)	6

Pomacea (*Limnopomus*) *aurostoma* ("Lea" Reeve)

A. aurostoma Rve. (1856, pl. 28, fig. 131), habitat unknown; not *A. aurostoma* Swby. (1909, p. 347), in synonymy of *A. cerasum* Hanley.

?*A. crassa* "Spix" Uribe (1925, Journ. Parasitology 11, p. 125), small brook near Valera, Ven.

A.N.S.P. 8192 (Swift Coll.), Yaraqui R., near Puerto Cabello; 50693 (R. Swift), New Granada; 120374 (Wheatley Coll.), Venezuela; 124619 (Wheatley Coll.), Cucutá, Colombia.

Although I must confess that the small brook form of *P. cerasum* (Hanley) is very similar to the same form (typical) of the present species, the Mexican shells (in A.N.S.P.) are lighter in texture and color. In addition, the larger specimens of the South American species are markedly different from *P. cerasum*, and the ranges of the two appear discontinuous. For these reasons, I am inclined to believe that Sowerby's *aurostoma* and the present form are cases of convergence under similar habitat conditions. As Lea obtained large collections from "New Granada," either Venezuela or Colombia was most probably the original habitat of the specimens that found their way into the Cuming collection. Also, Reeve's figure is most closely matched by the South American specimens cited above.

This South American species is quite similar to *P. crassa* (Swainson), but the umbilicus is apparently always distinctly rimate and the color bands are very obscure or quite absent. The peristomial callus in most of the specimens is almost white, but the orange pigmentation that gave the species its name is present in a few of them.

	Dimensions				
Reeve, pl. 28, fig. 131.....	26.7	86(23.0)	67(18.0)	80(14.4)	
A.N.S.P. 50693					
Means, 10 adults	25.3	87(22.1)	65(16.4)	83(13.6)	4.9
Minima, 10 adults	18.7	82(15.7)	60(11.8)	78(10.0)	4½
Maxima, 10 adults	31.9	93(27.7)	69(20.7)	88(17.1)	5¼
A.N.S.P. 8192	32.0	85(27.3)	63(20.1)	83(16.7)	5¼
A.N.S.P. 120374	36.3	83(30.0)	59(21.4)	82(17.6)	5½
A.N.S.P. 124619	29.1	80(23.3)	61(17.7)	78(13.8)	5¼

Pomacea (*Limnopomus*) *interrupta* (Sowerby)

A. interrupta Swby. (1909, p. 361, text fig.), Laguna Urao, Ven.; Kobelt (1913, p. 207, pl. 73, fig. 10); Alderson (1925, p. 52, pl. 11. figs. 6, 7).

Sets from along shore at Boca Norte del Rio Catatumbo, Lago de Maracaibo (H, X, b, 34; immature); from a pool in brook near Estación Táchira (H, VI, b, 35); from swift water in a small tributary to the Rio Uracá (H, VI, b, 36); from Quebrada La Fría, a lowland brook (H, VIII, b, 41); and a dead shell from bank of Rio Catatumbo at Encontrados (H, X, 46).

This species varies in color pattern from unicolor to obscurely banded. Usually the specimens from the smaller streams develop numerous varices, where the color bands become more distinct, owing to the slower growth, and produce the pattern that gives the species its name. Some of the shells from the mouth of the Rio Catatumbo are without varices and show no trace of the spiral bands. The apex in almost all cases is badly eroded. Apparently this species can assume adult appearance at almost any size. All my specimens are imperforate, except the largest, which has a very shallow crack due to an earlier injury. The animal possesses a well-developed siphon, as in *Pomacea* s. s.

	Dimensions				
Sowerby (text)	28	79(22)	64(18)	67(12)	6(?)
H, X, b, 34					
Largest immature	26.2	78(20.5)	77(20.2)	63(12.7)	dec.
H, VI, b, 35					
Means, 12 adults.....	27.4	78(21.4)	68(18.6)	68(12.6)	dec.
Minima, 12 adults	20.9	75(16.2)	62(14.9)	62 (9.7)	4.
Maxima, 12 adults...	32.1	84(25.3)	73(21.5)	73(14.8)	5¼
H, VI, b, 36					
Two adults	28.2	77(21.7)	65(18.4)	68(12.6)	dec.
	25.1	80(20.0)	71(17.7)	77(13.7)	dec.
H, VIII, b, 41.....	38.1	80(30.4)	68(26.0)	74(19.2)	dec.
H, X, 46.....	43.8	80(34.9)	68(29.7)	68(20.4)	dec.

Pomacea (*Effusa*) *cingulata* (Philippi)

A. cingulata Ph. (1851, p. 19, pl. 5, fig. 3); Mart. (1873, p. 202), Lago de Valencia, Ven. (type locality).

A.N.S.P. 50696 (Swift Coll.), Yaraqui River near Puerto Cabello; 50751 (Allison), Lago de Valencia; 120215 (Swift), Venezuela.

The group *Effusa* Jousseaume (1889, Mém. Soc. Zool. France 2, p. 255), type *E. luteostoma* Jouss. (=*Helix glauca* L.), is here used as a section to include *P. glauca* and its allies. *Marisa* Gray (1824, Phil. Mag. and Journ. 63, p. 276), type *M. intermedia* Gray (*l.c.*), from Brazil, has been considered as applicable to this group, but, from his description of *M. intermedia*, I suspect that he actually had before him a half-grown specimen of *P. cornu-arietis*, or some allied species; certainly the words "Shell nearly discoidal . . . spire slightly concave, nearly flat . . . axis 11/20, diameter 1 inch" apply to no known species of the present group. As *M. intermedia* never has been identified, the best place for the genus founded on it is in the limbo of absolutely unidentifiable names! In any case, *M. intermedia* Gray has nothing in common with *A. intermedia* Fér. (1824?, Voy. Uranie, Zool., p. 489).

From the specimens before me, *P. cingulata* seems to be quite variable in form, although it always has a smaller umbilicus and is a much thinner and more fragile shell than *P. glauca*. Two of the specimens are unicolor, and thus slightly resemble *A. prunulum* Reeve. In the original set no. 120215, Swift had included a shell of similar texture and also unicolor, which agrees closely with *P. glauca neritina* in form (see be-

Dimensions

Philippi (pl. 5, fig. 3)	36.1	93(33.5)	80(29.0)	71(20.6)	about 5
A.N.S.P. 50696					
Means, 4 adults...	38.3	89(34.1)	72(27.6)	72(19.9)	5.7
Minima, 4 adults...	36.7	86(33.0)	68(26.2)	69(18.9)	5½
Maxima, 4 adults...	40.1	95(35.4)	78(28.5)	77(21.0)	5¾
A.N.S.P. 50751	35.1	89(31.2)	66(23.2)	78(18.2)	5½
A.N.S.P. 120215					
Means, 3 adults....	34.5	87(30.2)	72(25.0)	73(18.3)	5.3
Minima, 3 adults..	31.7	86(28.4)	69(23.8)	72(17.2)	5
Maxima, 3 adults..	39.2	90(33.7)	75(27.2)	76(19.7)	5¾

low, A.N.S.P. 8195), but I believe this to be a case of convergence in identical habitat, rather than evidence for a closer union of the species.

Pomacea (*Effusa*) *glauca* (Linné)

Type locality: now chosen at Tucacas, Venezuela. Distribution: Cayenne to central Venezuela (and Colombia?); Orinoco drainage basin to Guadeloupe, Lesser Antilles.

This is easily the most variable species that I have ever studied. If one selects small sets of any of the extreme forms, one would not doubt for a moment their specific distinction, but, when one works over such a large series as that in the Academy of Natural Sciences of Philadelphia, one is forced to admit that no sharp lines can be drawn in the entire series. As it has always been the custom to consider this protean assemblage as a number of distinct species, I still divide *P. glauca* into nine forms. However, I wish to emphasize the fact that at least the first six of these are not geographic subspecies in any sense of the word, as the various forms crop up again and again in widely separate localities. The nearest approach to geographic races might be distinguished on the basis of size; the largest shells (forms *a*, *b*, *c*) appear to be characteristic of the larger streams and more permanent swamps of the lowlands (mainly around the mouth of the Orinoco); the medium-sized ones (forms *d*, *e*, *f*) mainly turn up in smaller bodies of water and in the vicinity of the smaller streams; while my form *minuscula*, at least, was found only in a small, swampy brook. However, these differences are mainly, although not completely, due to the number of whorls; that is, small shells are usually those that have become conchologically mature at relatively early stages of growth. The higher shells (*neritina* and *dubia*) seem to center around Trinidad and the Lesser Antilles, while the lower ones appear to be more common towards the eastern and western limits of the entire range. However, typical *effusa* (+*gevesensis*) and typical *glauca* do occur in a single lot of shells, which I collected myself in one locality, while the same thing is true of the latter and *neritina*

in some sets in the A.N.S.P. Also the specimens cited from Colombia are intermediate between *neritina* and *balteata* (high forms).

The color variation is as great as the differences in form. Most of the shells from central Venezuela have a light ground color, varying from pearl-gray to yellowish. Those from the Orinoco and the Guianas are commonly much darker, while those from the Lesser Antilles are often bright green (cf. Philippi: 1851, pl. 12, fig. 2). However, one cannot be sure of the region on this basis as the exceptions are very numerous. The spiral color bands may be numerous or entirely absent and may vary in width from narrow lines to broad, confluent zones that almost obliterate the ground color. The color of the peristome varies from almost white through yellow to bright red; in many of the shells from the Orinoco, the color bands also show through the pigment of the callus.

The nine forms recognized here may be arranged somewhat arbitrarily in a square as follows:

	Giant	Medium	Dwarf
Flat spire	a. *oculus-communis* (Gm.) 43.9 133(58.5)*	d. *effusa* (Müller) 32.8 126(41.2)	g. *planorbula* (Ph.) 16.4 132(21.6)
Low spire	b. *philippiana*, new. 48.8 111(54.0)	e. *glauca* (Linné) 37.8 110(41.5)	h. *minuscula*, new. 21.7 110(23.8)
Globose	c. *dubia* (Guilding) 62.3 97(60.3)	f. *neritina* (Gmelin) 33.0 96(31.8)	i. *balteata* (Ph.) 29.7 95(28.2)

In the discussions of these forms, I have tried to include in the bibliographies all the changes in names and references to the principal monographs. Also I have included all the specimens of *P. glauca* in the Academy of Natural Sciences of Philadelphia, although many of them come from outside the usual limits of these studies.

* Altitude, major diameter index and major diameter of type. For form *c* dimensions are from Reeve's *oronocensis;* for *d*, from a shell in the A.N.S.P.; those of *f* are the measurements of an immature shell (Kammerer's fig.).

a. *oculus-communis* (Gmelin)

Helix oculus-communis Gmelin (1791, Syst. Nat. XIII, p. 3621), now restricted to Seba (Thes., pl. 40, figs. 3–5), habitat unknown.

A. geveana Ph. (1851, Chemn., p. 26, pl. 7, fig. 2), intermediate between this and form d. ?*A. geveanensis* Swby. (1909, p. 350), Cayenne.

A. castanea Mart. (1873, p. 203, pars), Pomeroon River, British Guiana.

Type locality: Rio Yaracuy, Venezuela, now chosen.

Range: reported from Cayenne, British Guiana, and central Venezuela.

A.N.S.P. no. 50662 (R. Swift), Rio Yaracuy, Ven.; approaching form *d*; no. 50596, same locality and collector (see *effusa*); no. 50613 (Swift Coll.), Demerara, British Guiana (mainly form *b*).

This includes simply the very large specimens of the subplanorboid form of *glauca*, which has usually been known under some variant of the name *gevesensis*. The largest specimen in the A.N.S.P. (50662) is very close to Seba's figure; it also happens to be a bleached shell with beautifully distinct bands.

	Dimensions				
Seba (pl. 40, figs. 3–5) . .	43.9	133(58.5)	94(41.5)	68(28)	
Philippi (pl. 7, fig. 2) . .	46.0	118(54.5)	89(40.8)	88(36.1)	
Martens ("Pomeroon")	68	125(85)		(45)	
A.N.S.P. 50662					
Two adults	44.4	128(56.8)	93(41.2)	67(27.8)	dec.
	39.3	119(46.6)	82(32.4)	72(23.2)	5¾

b. **philippiana**, new

A. castanea Ph. (1851, p. 41, pl. 12, fig. 1), Orinoco; not Desh. (1830, Encycl. Meth. Vers. II, p. 31).

A. gevesensis Lang (1924, Naut. 37, p. 75, pl. 4, fig. 2), Georgetown, British Guiana.

Type locality: canal near Georgetown, British Guiana (A.N.S.P. 70016).

Range: Surinam to Orinoco and Guadeloupe.

Guiana: A.N.S.P. 50613 (Swift Coll.), Demerara, approaching form *a*; 70016 (Russell), canal near Georgetown; 120485 (Gov. Rawson), Surinam, approaching form *c*; 132819 (Lang), Georgetown (young shells); 133996, same locality and collector.

Venezuela: A.N.S.P. 105220 (Bond Exped.), Rio Manamo (see extreme dimensions of *dubia*).

Guadeloupe: A.N.S.P. 50603 (see extreme dimensions of *dubia*).

This is now given a name in order to call attention to the fact that intermediates between *dubia* and *oculus-communis* do exist. Usually the lots in the A.N.S.P. are separate, but the Surinam set approaches *dubia*, while that from Demerara contains a shell near *oculus-communis*. The shells from Guadeloupe are rather different in appearance from the others (see *dubia*).

	Dimensions				
Philippi (pl. 12, fig. 1).	51.7	116(60.0)	89(45.8)	63(29.0)	
A.N.S.P. 70016					
Largest (type).....	48.8	111(54.0)	82(40.3)	64(25.9)	dec.
A.N.S.P. (Guiana)					
Mean, 5 adults.....	46.2	111(51.2)	83(38.8)	70(26.8)	dec.
Minima, 5 adults....	39.6	105(48.1)	77(35.7)	64(25.4)	6¼
Maxima, 5 adults....	50.8	122(54.0)	90(40.3)	72(30.3)	dec.

c. *dubia* (Guilding)

A. dubia Gldg. (1828, Zool. Jour. 3, p. 539, suppl. pl. 27, fig. 7, the type, and fig. 8), "Small river in Gulph of Paria" (type locality) and canals of Demerara, British Guiana.

A. balteata Ph. (1851, p. 21, pars, pl. 17, fig. 4), peculiar color and peristome.

A. oronocensis "Ziegler" Rve. (1856, pl. 10, fig. 45), Orinoco; Alderson (1925, p. 7, pl. 2, fig. 7). *A. orinocensis* Mart. (1873, p. 204), Orinoco (includes form *b*); Kobelt (1913, p. 149, pars, pl. 55, fig. 4).

A. glauca Vanatta (1915, p. 83), Rio Vagre and Rio Manamo, Ven. (see below).

Type locality: Gulf of Paria, probably one of distributaries of Rio Orinoco.

Range: Surinam to Orinoco and north to Guadeloupe.

Guianas: A.N.S.P. 50660 (Sawkins), Demerara; 50663 (Baillis), Guiana (young); 120238 (Wheatley Coll.), trenches at Georgetown (young); 120484 (Gov. Rawson), Surinam.

Rio Orinoco: A.N.S.P. 50614 (von dem Busch), young; 105219 (Bond Exp.), Rio Vagre; 105220 (Bond Exp.), Rio Manamo; 120467 (Wheatley Coll.).

St. Lucia (Lesser Antilles): A.N.S.P. 50602 (Swift Coll.), Port Castries; 120390 (R. Swift).

Guadeloupe: A.N.S.P. 50598 (Phillips); 50603 (Swift Coll.); 50661 (Swift Coll.); 120214 (Wheatley Coll.).

This is the large, heavy shell, with a raised, but usually eroded spire, that has commonly been known as *oronocensis*. Guilding's name, with practically the same type locality, was equally well figured and has priority. *A. pachystoma* Philippi (1849, Zeit. Mal., p. 17), described from Brazil, may belong somewhere between this and the preceding form, as some

	Dimensions				
Reeve (pl. 10, fig. 45)..	62.3	97(60.3)	83(51.9)	67(35.0)	dec.
A.N.S.P. (Guiana)					
No. 50660.....	58.3	97(56.5)	71(41.2)	72(29.7)	6¼
	51.8	102(52.6)	75(38.9)	79(30.7)	dec.
No. 120484.....	56.2	107(60.4)	78(44.1)	74(32.7)	dec.
A.N.S.P. (Orinoco)					
Means, 10 adults....	58.5	101(59.2)	78(45.4)	67(30.4)	6½
Minima, 10 adults...	53.7	96(52.1)	75(40.4)	64(28.2)	dec.
Maxima, 10 adults...	65.7	110(69.2)	80(52.8)	72(35.5)	dec.
A.N.S.P. (St. Lucia)					
No. 50602.....	64.0	100(63.7)	72(46.0)	71(32.5)	dec.
	60.2	98(59.3)	71(43.0)	79(34.1)	dec.
No. 120390.....	60.3	96(58.2)	72(43.2)	75(32.6)	dec.
A.N.S.P. (Guadeloupe)					
Means, 6 adults.....	54.1	101(54.7)	76(41.1)	76(31.5)	6¼
Minima, 6 adults....	47.4	93(49.6)	67(35.0)	74(26.8)	6
Maxima, 6 adults....	64.3	112(65.6)	82(48.1)	82(37.2)	6½

specimens in the A.N.S.P., from Guadeloupe, have similarly thickened peristomes. For the present, it seems best to keep it separate, as *P. glauca* is not known to range into Brazil.

d. *effusa* (Müller)

Nerita effusa Müll. (1774, Verm. II, p. 175), habitat unknown.

A. gevesensis Desh. (1838, Ann. s. vert. III–8, pp. 535, 541), shape founded on Gevens (pl. 3, fig. 20), but of lesser dimensions. *A. geveana* Alderson (1925, p. 5, pl. 2, fig. 2), approaching true *glauca*.

†*A. castanea* (pars) Mart. (1873, p. 203), Puerto Cabello, Ven.

Type locality: Rio Yaracuy, Ven. (see A.N.S.P. 50596).

Range: known certainly from central Venezuela.

Extreme individuals in lots of *glauca* from swamps along Rio Aguirre (Orinoco drainage) near Bejuma (H, XIII, 10) and in temporary forest pools along Rio Arca at Palma Sola (H, XIII, 20). A.N.S.P. 50596 (R. Swift) Rio Yaracuy (approaching form *a*).

Nerita effusa Müller was founded on a series of medium-sized shells (14–18 lines), "In Museo Moltkiano." The first figure cited by its author (Lister, pl. 128, fig. 28, = *A. guyanesis* Lam.) is, of course, an error of some sort; the other two represent the subplanorboid form of this species. Müller apparently also had higher specimens like typical *glauca*, but he expressly separates them as a subordinate variety on p. 176. As a result, Deshayes had no right to shift *effusa* to the synonymy of *glauca*, in order to make way for his *gevesensis*, which is the true *effusa* of Müller. Kobelt's use of the term *effusa* (see form *f*) is quite impossible.

		Dimensions			
Müller (text)		31.6–40.6			6
Deshayes (*gevesensis*)	35	120(42)			6–7
Geves (pl. 3, fig. 20)		(51.6)			
H, XII, 10	38.7	120(46.4)	88(34.1)	70(27.7)	dec.
H, XIII, 20	38.1	122(46.3)	84(32.2)	69(22.2)	6
A.N.S.P. 50596	32.8	126(41.2)	87(28.5)	69(19.8)	dec.
	36.8	121(44.5)	87(32.0)	59(19.0)	dec.
	43.0	123(52.7)	86(37.2)	70(26.2)	dec.

e. *glauca* (Linné)

Helix glauca L. (1758, Syst. Nat. X, p. 771), habitat unknown; Linné (1764, Mus. Lud. Ulr., p. 667), first vaguely recognizable description; Born (1780, Vindob., p. 377); Schröter (1784, Einleit. 2, p. 145), restricted to Knorr (1771, Vergn. 5, pl. 5, fig. 3); Gmelin (1791, p. 3626), same restriction. *A. glauca* Ph. (1851, p. 43, pl. 12, fig. 4); Rve. (1856, pl. 18, fig. 85); Mart. (1873, p. 204), Caripe, Barruta (near Carácas); Kobelt (1913, p. 147, pl. 55, fig. 6); Alderson (1925, p. 1, pl. 1, figs. 1–8).

Nerita effusa, var. Müll. (1774, p. 176). *A. effusa* Sw. (1822, Zool. Ill. 3, pl. 157, middle figures), young shells approaching form d; Guppy (1864, Ann. Mag. Nat. Hist. (3)14, p. 243); Guppy (1866 (3)17, p. 44), Trinidad.

A. crocostoma Ph. (1851, p. 42, pl. 12, fig. 3), Carácas (enlarged aperture); Alderson (1925, p. 7, pl. 2, fig. 6). *A. luteostoma crocostoma* Kobelt (1913, p. 153, pl. 56, figs. 4–12), Puerto Cabello.

A. tamsiana "Dkr." Ph. (1851, p. 51, pl. 16, figs. 1, 2), Puerto Cabello (young shells); Dkr. (1852, Zeit. Mal. 9, p. 27); Mart. (1873, p. 202).

A. luteostoma Rve. (1856, pl. 18, fig. 84), Venezuela, not Swainson (1822, pl. 157, top and bottom figures); Mart. (1873, p. 203, pl. 1, figs. 20), swamps Yaracuy, Carácas, Caripe (includes form *f*); Kobelt (1913, p. 152, pl. 55, fig. 5, pl. 56, figs. 1–3); Alderson (1925, p. 5, pl. 2, figs. 3, 4); Germain et Neveu-Lemaire (1925, Ann. Parasitologie 4, p. 304), Carácas. *Effusa luteostoma* Jouss. (1889, p. 255), Laguna de Espino, near Carácas.

A. guadelupensis Mart. (1857, Mal. Bl. 4, p. 199), "Caripe auf Guadeloupe."

A. gevcana and var. *suprafasciata* Kobelt (1913, p. 156, pl. 57, figs. 1–11).

Type locality: Rio Tuca, near Tucacas, Venezuela, now chosen (H, VIII, b, 31).

Range: British Guiana to Colombia (?) and north to Guadeloupe.

British Guiana: Univ. of Mich. Exped., in ditches at Dunoon, near Georgetown (approaching forms *d* and *f*).

Eastern Venezuela: A.N.S.P. 50599 (R. Tate), Upata, (young shells); 120360 (Stevens), Rio Fumari (Yuruari), Cantón Upata, approaching form *h* (Essequibo drainage); 125620, same locality and collector (young shells).

Central Venezuela: sets from ditches along Rio San Estéban (H, VIII, b, 2); from swamps along Rio Aguirre (H, XII,

10), near Bejuma (Orinoco drainage basin); from irrigation ditches near Nirgua (H, VIII, b, 19); from caños (H, VIII, b) and forest pools (H, XIII) near Rio Aroa at Palma Sola (20, 22); and from swamps along Rio Tuca (a small creek) near Tucacas (H, VIII, b, 31). A.N.S.P. 50608 (Swift Coll.), Carácas (mainly form *f*); 50609 (ditto), Rio Guaiguaza near Puerto Cabello (young shells); 50615, same locality and source; 120422 (Starke), Puerto Cabello, greenish eggs; 120423, same locality and source; 120460 (T. Bland), Puerto Cabello.

Venezuela (no exact locality): A.N.S.P. 50593 (Swift); 50607 (Wilson); 120393 (Swift); 120421 (Wheatley Coll.); 120461 (ditto), young shells.

Colombia (?): A.N.S.P. 120420 (Wheatley Coll.), Cuenta, New Granada (approaching forms *f* and *i*).

Trinidad: A.N.S.P. 50611.

Martinique: A.N.S.P. 85068 (Milwaukee Public Mus.), mainly forms *f* and approaching *i*.

Guadeloupe: A.N.S.P. 50594 (Gabb), mainly form *f*.

The original description of Linné is totally unrecognizable, while that in 1764 might include any member of the *effusa* group. The first subsequent revisor appears to have been Born (1780), who cited three figures (Seba: Thes., pl. 38, fig. 8[1]; Geve, pl. 3, fig. 20; and Knorr, pl. 5, fig. 3), and gave a good description but impossible dimensions. Schröter (1784) soon afterwards limited this conception by questioning the figure of Seba (and with good reason), and dropping that of Geve. This action was ratified by Gmelin (1791), who also definitely separated, as distinct species, *H. oculus-communis* (form *a*) and *H. neritina* (form *f*). Apparently on the basis of the first figure cited by Müller (*A. guayanensis* Lam.), he also lumped all of *effusa* (including the Geve citation) as a variety of *H. ampullacea*. Thus, both Schröter and Gmelin limited *H. glauca* to the figure in Knorr, which may be taken as the type of the species.

[1] This is not the figure cited by Gmelin for *oculus-communis*, but represents a dorsal view of a higher shell.

Knorr's figure represents a bleached shell (as indicated also by the Linnaean name), with a slightly raised spire, such as can still be picked up in large numbers throughout central Venezuela. I now choose as the type locality the Rio Tuca, as shells from that place closely match the figure cited.

A. luteostoma of most authors is nothing more nor less than the brightly colored shell from the living animal of exactly the same form. *A. luteostoma* Swainson, however, is quite a different thing; his beautiful figures represent a high-spired shell, without the arched upper margin of the peristome that runs through all the forms of *glauca,* and with an absolutely unique coloration. No author has ever matched this shell, and *A. luteostoma* must still be regarded as a species of unknown localization. The form here called *neritina* comes the closest to it. *A. luteostoma* Philippi (1851, p. 42, pl. 12, fig. 2) is intermediate between true *glauca* and the form *neritina.*

Although *A. crocostoma* Philippi falls between typical *glauca* and *effusa* in dimensions, it does not resemble the latter, but is simply a form of *P. glauca* with swollen last whorl and enlarged aperture. This sort of shell is especially common in the lots from around Puerto Cabello. My own shells from Rio San Estéban are heavily coated with some deposits so as to be almost black; when cleaned, they are olive-brown with chocolate-colored stripes.

A. tamsiana is founded on young specimens of true *glauca;* I can match either of Philippi's figures in the material from San Estéban (probably topotypes), Palma Sola, and Tucacas. Shells in this phase are most abundant in the flood-channels that anastomose through the heavy lowland forests around Palma Sola; these were dry at the time collected and the dead and estivating specimens occurred among terrestrial species. Apparently, such conchologically immature animals may become sexually ripe, as, at Tucacas, I found them in copulation with each other and with animals of mature shell form. From my field notes, the conchologically mature males are but slightly smaller than the females with which they were found paired.

	Dimensions				
Knorr (pl. 5, fig. 3)...	37.8	110(41.5)	.....	.....	...
Philippi (*crocostoma*)..	28.5	113(37.8)	83(23.7)	78(18.4)	6
Philippi (*tamsiana*)....	21.7	97(21.0)	66(14.3)	78(11.2)	...
	35.3	108(38.3)	70(24.7)	99(24.4)	5½
Martens (*luteostoma*)..	38	103(39)	.....	(10.5)	...
Martens (*guadelupensis*)	29	109(31.5)	.....	(17)	5
Kobelt (*suprafasciata*).	33	103(34)	76(25)	?(14)	...
British Guiana (U. of M.)					
Means, 10 adults.....	32.8	105(34.3)	76(24.9)	72(17.9)	dec.
Minima, 10 adults....	29.7	99(31.0)	71(22.8)	67(15.7)	dec.
Maxima, 10 adults...	38.1	116(44.2)	82(30.2)	76(20.5)	dec.
H, VIII b, 2					
Means, 8 adults.....	33.7	104(35.0)	79(26.8)	72(19.2)	dec.
Minima, 8 adults....	31.9	101(33.4)	76(25.4)	68(18.3)	dec.
Maxima, 8 adults....	35.4	109(36.7)	82(28.8)	74(20.2)	dec.
H, XII, 10					
Means, 12 adults....	36.5	111(40.6)	82(30.1)	72(21.6)	dec.
Minima, 12 adults....	31.7	104(35.2)	79(25.3)	68(17.9)	5¼
Maxima, 12 adults...	42.8	120(48.7)	88(34.2)	77(25.4)	6
H, VIII, b, 20					
One adult.....	30.9	100(30.8)	79(24.4)	71(17.4)	5½
H, XIII, 20					
Means, 10 adults.....	34.5	108(37.3)	80(27.6)	69(19.1)	5.6
Minima, 10 adults....	30.5	100(33.2)	78(23.7)	66(16.1)	5¼
Maxima, 10 adults...	40.2	122(46.3)	84(32.7)	75(23.4)	6
H, VIII, b, 31					
Means, 27 adults.....	35.3	107(37.8)	81(28.3)	70(20.0)	5.6
Minima, 27 adults....	28.2	99(29.4)	70(22.9)	60(16.2)	5¼
Maxima, 27 adults...	41.3	115(43.9)	87(33.8)	80(24.4)	6
A.N.S.P. (central Ven.)					
Means, 10 adults.....	37.6	103(38.5)	77(28.9)	72(20.9)	5.6
Minima, 10 adults...	31.7	95(32.7)	67(25.7)	65(18.0)	5¼
Maxima, 10 adults...	45.3	108(46.7)	84(36.3)	84(28.2)	5¾
A.N.S.P. (Venezuela)					
Means, 10 adults.....	34.8	109(37.9)	82(28.4)	73(20.7)	5.5
Minima, 10 adults....	31.7	100(34.2)	75(26.3)	67(17.8)	5½
Maxima, 10 adults...	40.9	115(41.0)	85(30.7)	80(21.9)	5¾
A.N.S.P. (Colombia?)					
120120, two adults...	33.5	107(35.7)	79(26.6)	72(19.1)	5½
	28.3	99(27.9)	77(21.7)	72(15.7)	5¼
A.N.S.P. (Trinidad)					
50611, one adult.....	37.8	103(38.9)	78(29.3)	71(20.9)	5½

f. *neritina* (Gmelin)

Helix neritina Gmelin (1791, p. 3638), now restricted to citation of "Kammerer Conch. Rudolst. p. 185, n. 2. t. 11. f. 7," habitat unknown.

??*A. luteostoma* Sw. (1822, pl. 157, top and bottom figures). !*A. luteostoma* Ph. (*l. c.*) and Mart. (1873, p. 203), in part.

?*A. castanea* Deshayes (1830, Encycl. Meth. Vers. II, p. 31), habitat unknown.

A. teres Ph. (1851, p. 33, pl. 10, fig. 4), young shells of unknown habitat.

A. cubensis, auct.; not of Rve. (1856, pl. 18, fig. 83), Cuba; nor of Morelet (1849, Test. Nov. I, p. 24), northern Cuba.

A. effusa conica Guppy (1866, Ann. Mag. Nat. Hist. (3)17, p. 44), Trinidad, not *Helix conica* Wood (1828). *A. effusa tristis* Guppy (*l.c.*), Trinidad (unicolor).

A. glauca effusa Kobelt (1913, p. 158, pl. 58, figs. 6–10), Trinidad. *A. glauca* (pars) Alderson (1925, pl. 1, figs. 9–10, pl. 2, fig. 1), and approaching form *h*.

Type locality: Belmont, near Port of Spain, Trinidad, now chosen.

Range: Colombia (?); Puerto Cabello to Trinidad and Guadeloupe.

Colombia (sens. lat?): A.N.S.P. 50610 (Schaufuss), approaching form *i*.

Venezuela: sets from ditches near San Estéban (II, VIII, b, 2) approach this form (see *glauca*). A.N.S.P. 50597 (Swift Coll.), Puerto Cabello; 50601 (Blume), Rio Güere, prov. Barcelona; 50608 (Swift Coll.), Carácas (with true *glauca*); 50612 (Swift Coll.), Puerto Cabello (young); 50617 (Swift Coll.), Rio Yaracuy; 8195 (R. Swift), Venezuela (originally in lot 120215 with *P. cingulata*, which see); 120391, unicolor (approaching *prunulum* Rve.).

Trinidad: A.N.S.P. 84741 (Clapp), Belmont, near Port of Spain (mainly young); 120316 (Wheatley Coll.), young, brightly banded shells, labeled *A. effusa conica* (from Guppy?); 120459 (Wheatley Coll.)

Tobago: A.N.S.P. 50606 (Swift Coll.), approaching form *i*.

St. Lucia: A.N.S.P. 120462 (Wheatley Coll.).

Martinique: A.N.S.P. 85068 (Milwaukee Public Mus.), approaching forms *e* and *i*.

Guadeloupe: A.N.S.P. 50594 (Gabb), mainly young.

Kammerer's figures, on which *Helix neritina* was founded, distinctly represents an immature shell of the high-spired form of *glauca*. *A. castanea* Desh. seems to be the adult of the same thing; its author later placed it in the synonymy of *A. luteostoma* Sw., which also resembles the present form to a considerable degree. *A. teres* Ph., described from young shells without locality, has usually been associated with a superficially similar Cuban species, *A. poeyana* Pils. (1927, p. 251, pl. 21, figs. 7–9). Guppy's *conica* is probably preoccupied, but his *tristis* might be used for the unicolor shells of the present form, although *A. prunulum* Reeve (see form *i*)

Dimensions

Kammerer (pl. 11, fig. 7)	33	96(31.8)	.....	.....	....
Swainson (*lutcostoma*)	42.2	86(36.4)	70(29.5)	77(22.7)	about 6
Deshayes (*castanea*)	45	?(38)base	.....	.....	....
Philippi (*teres*)	35.0	93(30.4)	69(24.0)	72(17.3)	....
A.N.S.P. (Colombia)					
50610, one adult	30.6	91(27.9)	67(20.6)	69(14.3)	5½
A.N.S.P. (Venezuela)					
8195, one adult	36.1	94(34.0)	73(26.3)	70(18.4)	5¾
Means, 6 adults	39.5	98(38.6)	73(28.8)	72(20.8)	5.6
Minima, 6 adults	35.3	92(34.0)	67(25.6)	67(18.4)	5½
Maxima, 6 adults	46.3	107(43.2)	79(33.4)	76(24.0)	6
A.N.S.P. (Trinidad)					
120459, one adult	33.7	96(32.3)	68(22.8)	78(17.7)	....
A.N.S.P. (Tobago)					
Means, 4 adults	31.9	93(29.6)	70(22.3)	73(16.3)	5½
Minima, 4 adults	30.0	90(27.6)	69(20.7)	70(15.0)	5½
Maxima, 4 adults	34.3	95(32.6)	71(23.8)	80(17.2)	5½
A.N.S.P. (St. Lucia)					
120462, two adults	38.0	92(34.8)	66(25.2)	70(17.6)	5¾
	35.7	92(32.7)	70(24.9)	80(19.8)	5½
A.N.S.P. (Martinique)					
85068, two adults	40.2	103(41.6)	75(30.2)	77(23.2)	dec.
	27.8	95(26.3)	75(20.8)	65(13.5)	5¼
A.N.S.P. (Guadeloupe)					
50594, one adult	39.8	97(38.8)	74(29.5)	72(21.1)	dec.

is prior. Green ground color, with few or no spiral bands, is a not uncommon feature among shells of this form; very light, unicolor shells are also in the lots before me. One of these last (A.N.S.P. 8195) is a thin shell, somewhat similar in texture to *P. cingulata*, and had been included in a set of that species by Swift.

g. *planorbula* (Philippi)

A. planorbula Ph. (1851, p. 27, pl. 7, fig. 3), habitat unknown. ?*A. planorbula* Rve. (1856, pl. 27, fig. 126) and Swby. (1909, p. 359), Para, Brazil.

Type locality and range: unknown.

I have seen no specimens of this very peculiar little shell, but it seems to bear much the same relation to the *effusa* series that my *minuscula* does to typical *glauca*. I should expect to find it under conditions similar to those of the next form. I am very doubtful whether either Reeve's figure or Sowerby's record belong in the synonymy of the present form.

Dimensions

Philippi (pl. 7, fig. 3).	16.4	132(21.6)	73(13.6)	75(10.2)	....
Reeve (pl. 27, fig. 126).	12.5	125(15.6)	89(11.1)	75(8.3)	....

h. **minuscula**, new

Type locality: Quebrada Sucremo, a small, swampy brook in heavy forest near Boquerón, Venezuela (II, VIII, b, 29), in the drainage area of Rio Aroa. The animals were found in débris along the borders of the pavement formed by the dead shells of *Pachychilus laevissimus* (see below), and apparently did not live in the pools.

Range: A.N.S.P. 120360, a single specimen approaching this form from Rio Yuruari, Cantón Upata, Ven. (Stevens).

Shell (pl. XXX, fig. 8): openly umbilicate, depressed solid; ground color greenish buff; with dull, chocolate-brown, spiral bands of varying number and width; tip of spire reddish amber. Surface: apical 1½ whorls smooth and shining; later

whorls with fine growth wrinkles, crossed by numerous, delicate, spiral ridgelets, which are most prominent on apical side. Spire: short conic. Whorls: 5 to 5½, narrow and high, shouldered above; suture canaliculate. Aperture: oval, almost vertical, but with apical edge slightly behind basal; peristome sharp, with a slight inner callus, which is usually bright scarlet in color; columellar margin well reflected.

This is evidently a dwarfed form of *P. glauca*, with a lesser number of whorls, but with the compressed last whorl and well-developed peristome of adult shells. It does not especially resemble young specimens of *P. glauca* (cf. Philippi's figs. of *tamsiana*). As will be seen from the tables of dimensions, the type lot does not intergrade with any of the sets of typical *glauca*, so that *minuscula* appears to be a very well-marked ecological race.

Dimensions

H, VIII, b, 29					
Type shell.....	21.7	110(23.8)	86(18.7)	64(12.0)	5
Means, 12 adults.....	24.7	104(25.6)	81(20.0)	66(13.2)	5¼
Minima, 12 adults....	21.7	97(23.8)	76(18.7)	59(11.7)	5
Maxima, 12 adults...	28.7	110(28.7)	86(22.8)	71(14.8)	5½
A.N.S.P. 120360					
One adult.....	28.4	106(30.2)	79(22.5)	67(15.0)	5

i. *balteata* (Philippi)

A. balteata Ph. (1851, p. 21, pl. 5, fig. 7), but not his "adults" (pl. 17, fig. 4).

?*A. prunulum* Rve. (1856, pl. 18, fig. 82), New Granada; Alderson (1925, p. 8, pl. 2, fig. 8), Colombia (sens. lat.).

Type locality: Trinidad now chosen.

A.N.S.P. 67316 (B. Sharp), Trinidad; also shells from Venezuela (120391), Colombia (50601), Tobago (50606), and Martinique (85068) that are intermediate between this form and *neritina* (which see).

Philippi's first figure of his *balteata* appears to represent an adult shell (now chosen as type) of what would bear the same relation to the *dubia-neritina* series as does my *minuscula* to

typical *glauca*. *A. prunulum* Reeve is slightly larger and relatively higher than any specimens before me; it also appears to be quite unicolor.

	Dimensions				
Philippi (pl. 5, fig. 7)..	29.7	95(28.2)	72(26.4)	69(14.8)	4–5
Reeve (pl. 18, fig. 82)...	35.8	88(31.6)	75(27.0)	72(19.5)	about 5
A.N.S.P. 67316, (adult)	28.2	90(25.4)	69(19.3)	65(12.8)	5¼

Pomacea (*Ceratodes*) *cornu-arietis knorri* (Philippi)

Ceratodes fasciatus Guilding (1828, p. 540, suppl. pl. 28, figs. 4, 7), small river in Gulf of Paria (p. 359); not *A. fasciata* Roissy (1805), now in *Pomacea*.

A. knorri Ph. (1851, p. 57, pl. 18, fig. 3), Trinidad. *A. cornu-arietis* Mart. (1873, p. 204), Carácas, Cumaná.

Dead shells from near Rio Catatumbo at Encontrados (II, XII, 46). A.N.S.P. (Venezuela): 50742 (Swift Coll.), Maracaibo; 50743 (F. R. Cocking), Carácas; 50759 (Swift Coll.), La Guaira; 120157 (Wheatley Coll.); 120160 (T. Bland).

All the large specimens of this species before me, from Trinidad, Dutch and British Guiana, Venezuela, and the littoral of Colombia and Panamá, show to some degree the steep sutural slope of the last whorl, on which Philippi mainly based his species. They are much more variable as regards strength of growth lines, as Martens has already pointed out. Guilding's type locality for his *C. fasciatus* also falls within these limits, and his name should be used for this subspecies if *Ceratodes* is recognized as a distinct genus. The animal of *knorri*, according to Guilding's figure, seems to differ quite markedly in relative length to siphon and tentacles, from that of *A. chiquitensis* d'Orb. (1846, Voy. Amer. Mer. Atlas Moll. pl. 48, figs. 7, 8), from Prov. Chiquitos, Bolivia.

MELANIIDAE

Pachychilus laevissimus (Sowerby)

Melania laevissima Swby. (1824, Zool. Jour. 1, p. 60), Rio de La Guayra, La Guayra, Ven.; Mart. (1873, p. 206), Carácas, La Guaira,

Puerto Cabello. *Pachycheilus laevissimus* Jouss. (1889, p. 257), San Estéban.

Abundant on rocks in and out of water; usually in small mountain quebradas, but occasionally in larger streams; at La Guaira (Rio Macuto; H, VI, a, 1), San Estéban (tributaries of Rio San Estéban; H, VI, VII, 2, 3, 4), near Bejuma in Banco Largo, Rio La Mona, and Rio Chirgua (Orinoco drainage; H, VI, VII, 7, 11, 13, 14), and near Nirgua in Rio Piña (Orinoco drainage; H, VI, a, 18); not found in similar places at the headwaters of the Rio Aroa near Aroa, but occurring in large numbers in a small, swampy brook, Quebrada Sucremo, near Boquerón (H, VIII, a, 29), where it had built a pavement by the deposition of dead shells which had become coated with heavy calcareous deposits.

A.N.S.P. 26830 (Swift Coll.), La Guaira; 26831 (Phillips), Puerto Cabello; 63562 (Morelet Coll.), Carácas.

I am somewhat doubtful whether *Pachychilus* Lea (1850) can be used as a generic name for this species. The anonymous *Pachycheilus* (1840, Penny Cyclopedia 17, p. 454, footnote) is equivalent and prior, but appears to be simply an emendation of *Pachylabra* Swainson and should have no more status in nomenclature than any misspelling. *Cercimelania* is the next name in line for the present group.

The absence of *P. laevissimus* from its usual habitat in the headwaters of the Rio Aroa and its presence in a lowland brook in the lower valley of the same stream appear strangely contradictory. However, dams of calcareous seepage deposits, very similar to those formed under waterfalls in the mountain streams of the region, were noticed around Boquerón, and I am inclined to suspect that these actually do indicate the position of falls during a much earlier period in the erosion of the valley. The shell pavement, by which this species is truly forming its own environment in Quebrada Sucremo, is underlain by the same soft muck that forms the bottom in most parts of this little caño.

Throughout the region, *P. lacvissimus* appears unable to maintain itself in the larger streams, which vary enormously

in volume between the rainy and the dry seasons; the few specimens found in the larger creeks have been eroded almost beyond recognition, and probably had been washed down from the smaller tributaries. As will be seen from the records, this species crosses the Cumbres watershed into the northern terminals of the Orinoco drainage.

The radula (pl. XXVII, fig. 1) of an animal from La Guaira has 92 transverse rows (complete?). As is usual in the Melaniidae, the teeth proper are each raised some distance above their bases. In the central, the anterior margin of the base is deeply emarginate, and the posterior end is convex. The pedestal which supports the tooth proper is more deeply excavated anteriad than is the base, and slopes abruptly back from its posterior margin, so that the posterior edge of the definitive tooth forms a distinct transverse ledge. The tooth proper is strengthened by a median, longitudinal, semicylindrical thickening, which expands anteriad to support the cusp-bearing reflection. The median cusp is short and about twice as broad as the largest of the lateral cusps, of which there are three on each side. In the lateral tooth, the base is elongate and lies with its longitudinal axis oblique to the transverse axis of the ribbon. The tooth proper is considerably narrower than its base and has somewhat the shape of the T-lateral in some Helicinidae; it bears a major cusp with two minor endocones and two or three ectocones. The inner marginal is attached by a small oval base. The tooth proper is about two thirds as long as its base, and is demarcated posteriad by a prominent ledge. All the cusps are aculeate; the terminal one is largest and the other three form a decreasing series down the inner side of the tooth. The outer marginal is longer than the inner one, but the tooth proper is less than half the length of the entire structure, and so is actually smaller than the same part of the inner marginal.

**Doryssa atra* (Bruguière)

Bulimus ater Brug. (1792, Act. S. N. H. Paris I, p. 126), Cayenne (Leblond); *B. ater* "Richard" Lam. (1819, Ann. s. vert. VI, pt. 2, p.

164), in syn. *Melania truncata*. *?Melania atra* Mart. (1873, p. 207), Cumbres Mts. (Appun).

Melania semiplicata Lam. (1816, Encycl. Meth., pl. 457, figs. 3a, b); not Lam. (1804). *M. truncata* Lam. (1819, p. 164), "rivieres de la Guyane (Leblond)."

Bruguière's original description of this species is too brief for accurate recognition, but as Lamarck obligingly mentioned it in the synonymy of his *M. truncata*, which was founded on material from the same collector, and as it has been generally accepted, one hesitates to pronounce it unidentifiable. The usual citation of "Richard" as the authority for this species seems to have originated with Lamarck; Bruguière mentions no such person. This species seems to range from Dutch Guiana southward and eastward; but the next may enter Venezuela, although its occurrence in the Cumbres appears extremely dubious.

Doryssa lamarckiana Brot

D. lamarckiana Brot (1870, Am. Journ. Conch. 6, pt. 2, appendix, p. 305), Essequibo River, Guyana; Brot (1877, Chemn., p. 344, pl. 35, figs. 1, 1a).

A.N.S.P. 122765 (Wheatley Coll.), Rio Yuruari, Ven. (two specimens).

These specimens are undoubtedly of this species, but I am rather doubtful of Wheatley's localities, unless the name of the collector is also given.

Doryssa consolidata (Bruguière)

Bulimus consolidatus Brug. (1789, Encycl. Meth. I, p. 325), partially founded on Martini (Chenm. IX, p. 188, pl. 136, fig. 1258), from Surinam. *D. consolidata* Brot (1878, p. 354, pl. 36, fig. 9).

Melania circumscalata von dem Busch (1858, Mal. Bl. 5, p. 35), Pallo (?).

A.N.S.P. 26769 (R. Tate), Venezuela; 122721 (R. R. Stevens), Rio Yuruari, Cantón Upata; 124688 (Wheatley Coll.), Rio Yuruari; 124693 (R. R. Stevens), Rio Clara, Cantón Ciudad Bolivar (Orinoco drainage).

This appears to be the usual species in the western headwaters of the Essequibo system and evidently crosses the low

divide into the Orinoco drainage. It might be the shell identified by Appun as *M. atra.*

The radula (pl. XXVII, fig. 2), of a specimen from Kamaria, Cuyuni River, British Guiana (Elred and Morrison, 1925; A.N.S.P. no. 142817), has 157 transverse rows. The teeth are quite similar to those of *Pachychilus laevissimus*, but the central is relatively much smaller and the laterals are slightly smaller, while the marginals are actually about the same length (altogether smaller in proportion to the size of the shell). Also, the major cusp of each of the teeth is much larger in proportion to the minor ones. In addition, the distal end of each marginal is more broadly spoon-shaped; the major cusp is spatulate and one aculeate minor cusp is external; the other two are internal in position.

Doryssa gruneri (Jonas)

Melania gruneri Jonas (1844, Zeit. Mal. I, p. 49), Varinas (Barinas), Ven.; Mart. (1873, p. 207). *D. grüneri* Brot (1877–8, p. 357, pl. 35, fig. 9, pl. 6, fig. 6).

This name is evidently founded on immature specimens, probably of *D. consolidata* or some closely related species. Its definitive status must await adult material from the type locality.

Hemisinus lineolatus (Wood)

Strombus lineolatus Wood (1828, Ind. Test. Suppl., p. 13, pl. 4, fig. 11), habitat unknown. *Melania lineolata* Gray (1834, Griffith A. King. Moll., pl. 13, fig. 4); Mart. (1873, p. 207). *Hemisinus lineolatus* Rve. (1860, Conch. Icon., pl. 1, fig. 4), Venezuela; Brot (1878, p. 373, pl. 38, figs. 6a-c).

A.N.S.P. 120738 (Wheatley Coll.), Venezuela?

It is possible that Wheatley added this tentative locality on the basis of Reeve's citation.

Hemisinus strigilatus ("Dunker" Philippi)

Melania strigilata Ph. (1843, Abbild., Hft. 2, p. 12, pl. 2, fig. 14), Orinoco (Register).

A.N.S.P. 120814 (Wheatley Coll.), Rio Orinoco.

The two worn specimens in the A.N.S.P. satisfy the description of this species quite well, although they are more yellowish than Philippi's figures.

Hemisinus venezuelensis (Reeve)

Melania venezuelensis Rve. (1859, Conch. Icon., pl. 13, fig. 81), Porto Cabello; Mart. (1873, p. 207).

AMNICOLIDAE

Potamopyrgus (*Pyrgophorus*) *parvulus* (Guilding)

Paludina parvula Guild. (1828, Zool. Jour. 3, p. 537, suppl. pl. 28, figs. 1–3), St. Vincent. *Potamopyrgus parvulus* H. B. B. (1924, this series, no. 152, p. 70, pl. 11, figs. 45–47), Dutch Leeward Islands.

Bithinia spiralis Guppy (1864, Ann. Mag. Nat. Hist. (3)14, p. 244; 1866, v. 17, p. 43) Trinidad (animal and radula).

Two young shells from Rio Yumarito, a small creek near Bouquerón (H, IX, b, 27a).

These Venezuelan specimens have numerous, fine, spiral ridgelets, several of which are much more strongly developed, although none are definitely spinose. At first, this seems to be rather distinct from the usual coronate form of this species, in which a single spiral ridge is developed into a number of triangular points (cf. my fig. 47, cited above). However in a lot from Trinidad (A.N.S.P. 91474) all intergradations occur between these two extremes and the smooth form. If the variation with more than one strong spiral requires a name, Guppy's *spiralis* is available.

The radula (pl. XXVII, fig. 4) of an adult specimen of this species from Aruba, Dutch West Indies, is similar to those in most Amnicolidae, but, since most of the published descriptions of these are incorrect, it will be described in some detail. The central bears 13 long aculeate cusps on its reflection and has 3 basal cusps on each side. The lateral is attached by a very elongate base, which extends obliquely laterad and posteriad from its squarish body. This last bears an oblong peg, which extends posteriad from its dorsal surface and fits behind the corresponding embayment in the tooth next

posteriad. The reflection bears 13 hooked cusps, of which the 6th from the inside is about twice as large as any of the others. The inner marginal is roughly spoon-shaped. Its concave blade is more opaque in texture than the rest of the tooth and bears 35 small, aculeate cusps which run down its *outer* side. When the tooth is turned inward, these cusps point *dorsad* and lie in an obliquely transverse row along the anterior side of the tooth. The handle is elongate adze-shaped, so that its broad axis at the base of the blade is at an angle of about 45° to the long axis of the small basal surface for attachment. The inner side of this handle bears a large lamella, which extends mesiad and ventrad and must function as a support for the tooth. The notch shown in most figures of this marginal is actually an illusion, produced by refraction at the junction between the three divergent planes of the blade, handle and lamella. The outer marginal is thinner and more slender than the inner. Its blade bears about 30 still smaller, aculeate cusplets, which run down its morphologically *inner* side. When the tooth is turned inward, it lies over the outer marginal with the convex side of its blade uppermost, and with the cusps directed *ventrad* and forming an obliquely transverse row along its anterior edge. Thus, when the inner and outer marginals are both in the same position, their blades are almost mirror images of each other! The proximal end of the outer marginal is compressed almost at right angles to the broad axis of its blade.

The penis (pl. XXVII, fig. 3) of another specimen from Curaçao has an aculeate, jet black verge and a stouter, more lightly pigmented base, which bears three papillae on one side and a large, trilobate projection on the other and arises near mid-dorsal line. It seems closest to that in *Littoridina*. The females are considerably larger than the males and contain numerous embryos of various sizes.

Potamopyrgus (*Pyrgophorus*) *valenciae* (Preston)

Hydrobia coronata Mart., pars (1873, p. 208, pl. 2, figs. 13a, b), subfossil, Lago de Valencia, Ven. *Paludestrina valenciae* Preston (1909, Ann. Mag. Nat. Hist., p. 513, fig. 16), same locality and condition.

A.N.S.P. (C. S. Boyer and J. A. Shulze), Lago de Valencia (subfossil); 99401, paratype from Preston.

The smooth form of this species, as described by Preston, is usually more slender and has more deeply impressed sutures than *P. parvulus*. The coronate variation, which was figured by von Martens (*l.c.*), has a single row of spinules, which occupy a lower position on the shell than in *P. parvulus*; in addition, the greatest breadth of each spine is longitudinal, as if it were a development of the growth sculpture, instead of transverse, as in the spined form of Guilding's species. *P. valenciae* has been reported only in the subfossil state, so Martens' radular figures were probably made from Cuban specimens of one of the species included in his synonymy. Both the smooth and coronate forms of *P. valenciae* are included in the first lot cited above.

Potamopyrgus (*Aroa*) *ernesti ernesti* (Martens)

Hydrobia ernesti Mart. (1873, p. 209, pl. 2, fig. 12), subfossil, Lago de Valencia.

A.N.S.P. 99345, Lago de Valencia; 103082, ditto (from von Martens).

Potamopyrgus (Aroa) ernesti vivens, new subspecies

Numerous living specimens from pools in brooks and creeks (H, VI, VIII, IX, b), near Boquerón (26, 26a, 27, 29), Tucacas (31) and Estación Táchira (35).

This subspecies (pl. XXVIII, fig. 1) appears to be the commonest form in the small streams of central and western Venezuela. Living specimens are usually covered by a dark brownish deposit, but, when clean, are light yellowish green and translucent. Shells with adult characteristics vary greatly in size, but the females, which are larger than the males, attain considerably greater dimensions than any specimens I have seen of typical *ernesti*. The aperture is also more elongate. The parietal region of the peristome is sometimes shortly free in adults, although always adnate and incomplete

in younger specimens; in fully developed shells, its palatal edge may be very slightly but distinctly expanded, so that the basal region is slightly emarginate. The later whorls are covered with fine spiral ridgelets and very delicate growth wrinkles, of which every fourth or fifth one is slightly accentuated. The operculum (pl. XXVIII, fig. 7) is corneous and paucispiral.

	Dimensions				
P. ernesti					
Mart. (text and fig.).	2.5	72(1.8)	48(1.2)	92(1.1)	4–4½
Subsp. *vivens*					
H, VIII, b, 26, type..	3.61	81(2.92)	52(1.87)	87(1.62)	4½
Do., largest.....	4.29	72(3.11)	50(2.13)	78(1.66)	5
P. putealis					
H, VI, c, 35, type....	2.78	84(2.33)	57(1.59)	76(1.21)	4

The radula (pl. XXVIII, fig. 4) is similar to that of *P. parvulus,* but the central is more transverse, has its base deeper at the center and more attenuate laterad, and develops only two basal cusps on each side, very near its posterior margin. In addition, the other teeth are more elongate. The following table gives the number of cusps on each of the teeth.

	Central		Lateral	Marginals	
	reflection	base		inner	outer
P. parvulus...	6–1–6	3–3	5–1–7	35	30
P. e. vivens...	5–1–5	2–2	4–1–4	29	28
P. putealis...	6–1–6	2–2	6–1–6	25	24

The penis (pl. XXVIII, fig. 6) of a specimen from Estación Táchira has a long black verge and a stouter, less pigmented, but also quite simple base, which arises inside a circular fold, much to right of mid-dorsal line. The females contain numerous embryos, which attain a shell of about one whorl. As the shell agrees more closely with the smooth form of *Pota-*

mopyrgus than with that in *Littoridina,* this and the following species are placed in the former genus. As the penis is simpler than in either genus, and still is not bifid, as in *Amnicola* or *Hydrobia* (*Paludestrina*), I propose a new subgenus, **Aroa,** type ***P. ernesti vivens.***

Potamopyrgus (Aroa) putealis, new species

Specimens from two small ponds, each of which is the source of a small brook in the canyon-like valley of Rio Lobaterita near Estación Táchira (H, VI, c, 35, 38); station 35 is the type locality.

Shell (pl. XXVIII, fig. 2): small, turbinate, dull whitish and almost transparent; thin and fragile. Whorls: 4. Embryonic whorl: only one; surface finely punctate and with weak growth lines; no spirals observed. Later whorls: strongly convex, quite rapidly increasing in diameter and with deeply impressed suture, especially above last one; growth sculpture consisting of widely spaced, low, rounded threads with closely spaced, very fine wrinkles between them; spiral lines present but weak and obscure. Umbilicus: open and relatively large. Aperture: ovoid, almost vertical, with long axis inclined about 20° to that of shell. Peristome: simple and sharp; almost complete and with ends joined by a prominent callus; palatal edge very weakly emarginate below periphery; columellar margin simple. Operculum: much as in *P. ernesti.*

The radula (pl. XXVIII, fig. 5) of a specimen of this species from station 38 is very similar to that of *P. ernesti,* but the central is deeper and has more rectilinear sides; both it and the laterals bear more cusps (see above). I have no specimens of this species in alcohol, but the dried bodies in the largest shells contain numerous embryos, just as in *P. ernesti.*

This species is similar to *P. ernesti* in general appearance, but is lighter in color, thinner in texture, and more depressed in form. It also has more convex whorls with deeper suture and a larger umbilicus.

Potamopyrgus (Aroa) globulus, new species

A.N.S.P. 27237, labeled "*B. globulus* Dunker," Venezuela (Schaufuss).

Shell (pl. XXVIII, fig. 3): very large (for the genus), bulimoid in shape, light greenish horn colored and quite solid. Whorls: 5½, evenly convex and weakly shouldered above, with well-impressed suture; surface lustrous, with weak growth lines and microscopic spiral lines. Umbilicus: small, but open. Aperture: ovoid, almost vertical and with long axis inclined about 30° to that of shell. Peristome: simple and sharp, but very slightly flaring in palatal region; adnate for a short distance, but completed by a parietal callus; columellar margin narrowly reflected. Operculum: lacking from specimen.

	Dimensions				
Type specimen.....	9.2	74(6.85)	48(4.4)	83(3.65)	5½

I have been unable to find any published record of this species, represented in the collection of the Academy of Natural Sciences of Philadelphia by this unique specimen, so Dr. Pilsbry has generously permitted me to describe it. My use of the manuscript name will prevent confusion in case it has already been established. Although *P. globulus* is much larger than any other known species of the genus, it has much the shape and sculpture of *P. ernesti*, and it seems best to included it tentatively in *Aroa* and *Potamopyrgus*.

LYMNÆIDÆ

Lymnaea* (*Galba*) *cubensis Pfeiffer

Lymnaea cubensis Pfr. (1839, Arch. Naturg. 5, p. 354), Cuba; Mart. (1899, Biol. Cent. Amer., p. 378), Carácas, Ven. *Galba cubensis* F. C. Baker (1911, Chicago Acad. Sci., Spec. Publ. 3, p. 204, pl. 27, figs. 9–16).

PHYSIDÆ

Aplexa* (*Stenophysa*) *rivalis rivalis (Maton & Rackett)

1. *Bulla rivalis* M. & R. (1807, Trans. Lin. Soc. 8, p. 126), Hampshire, England (*sic*); Montagu (1808, Test. Brit., suppl., p. 97), West Indies.

Limnea rivalis Swby. (1822, Gen. Sh., fig. 9), Guadaloupe (type locality). *Physa rivalis* Mart. (1873, p. 199), Carácas, with *P. margaritacea* "Shuttl.," vested in synonymy. *Aplecta rivalis* Jouss. (1889, p. 22), Petare, near Carácas. *P. sowerbyana* Orb. (1841, Moll. Cuba I, p. 192, pl. 13, figs. 11, 13), subst. for *L. rivalis* Swby. *P. antonii* Küster (1844, Chemn. II, p. 12, pl. 2, figs. 6–8), Peru, with nude name, *P. peruviensis* "Mulf." Anton (1839, Verz., p. 48), vested in synonymy. *P. salleana* Dkr. (1853, P. Z. S. 21, p. 53), Santo Domingo. *P. venezuelensis* Mart. (1859, Mal. Bl. 6, p. 66), Lagunilla in Ven.; Mart. (1873, p. 199, pl. 2, fig. 11).

2. *P. peruviana* Gray (1828, Spic. Zool., part 1, p. 5, pl. 6, fig. 10), swamps between Lima and Callao, Peru.

3. *Aplexa rivalis brasiliana* Beck (1837, Index, p. 116), founded on "L. Tr. viii. iv. 2" (1807, Trans. Lin. Soc. 8, pl. 4, fig. 2), from Rio Janeiro (Brazil). *P. brasiliensis* "Koch" Küster (1844, p. 10, pl. 1, figs. 18–20), Brazil.

Most common and largest in pools along streams and savannah ponds near Bejuma (H, IX, b, 12; XII, 9, 10), but smaller form also near Palma Sola (H, XIII, 20), Boquerón (H, VIII, b, 26a) and Tucacas (H, XI, 30). A.N.S.P. 21167, Carácas; 64053 (Carácas, Dohrn).

Although the identification of the original description of *A. rivalis* with the West Indian[2] shell is far from satisfactory, it seems best to accept the verdict of Sowerby and most subsequent authors. However, fig. 2 of plate 4 in the original paper is not mentioned in the text and does look more like the Brazilian form named by Beck. In my opinion, *P. venezuelensis* Martens is based on large, fresh shells of the West Indian form; both the reddish tinge below the suture and the spiral striations are extremely variable in the lots before me.

A. peruviana (Gray) is a much larger shell (alt. 1 inch) and may be a separate species, although quite typical *A. rivalis* seems to occur in the same general region. Brazilian examples average somewhat stouter than typical *rivalis*, and may form a poorly marked subspecies, *A. rivalis brasiliana* Beck.

The maximum size of any lot of this species seems to vary with the extent and permanence of the body of water in which

[2] I must acknowledge my indebtedness to a manuscript of Dr. Pilsbry's for assistance on the synonymy of the West Indian forms of Physidae.

it lives. Thus the series from the small pools near Boquerón and Palma Sola are very much smaller than the shells from pools on the flats of Rio Bejuma (see dimensions given below).

	Dimensions				
Maton and Rackett, text	12.7	50(6.4)	.....	.....	....
Do., pl. 4, fig. 2.....	16.4	52(8.6)	76(12.4)	51(6.3)	....
Swby., fig. 9.....	14.8	51(7.6)	74(10.9)	44(4.8)	4½(?)
Orb. (*sowerbyana*), text and fig.	14	49(6.8)	72(10.0)	49(4.9)	5
Küst. (*antonii*), text and fig.	10	47(4.7)	71(7.1)	46(3.3)	5
Dkr. (*salleana*), text.....	13.4	.....	.....	.....	....
Mart. (*venezuelensis*), text and fig.....	18	51(9.2)	81(14.5)	39(5.7)	....
Küst. (*brasiliensis*), text and fig.	12.7	50(6.4)	67(8.5)	49(4.2)	4½
H, IX, b, 12					
Means, 6 large shells....	13.7	54(7.4)	73(10.0)	48(4.8)	5¼
Minima, 6 large shells...	12.0	52(6.5)	67(8.8)	45(4.0)	5
Maxima, 6 large shells..	14.4	57(8.1)	76(11.0)	52(5.4)	5½
H, XIII, 20					
Largest shell	8.7	58(5.0)	72(6.3)	48(3.0)	4¾

The following account of the anatomy of *A. rivalis* is mainly from the large individuals collected near Bejuma (H, IX, b, 12). The description of the reflected edge of the mantle collar is founded on sketches and notes made from living animals in the field.

Head (pl. XXIX, fig. 1): dorsoventrally flattened, with triangular lateral lobes, whitish below but with numerous black blotches dorsally; mouth a longitudinal slit in a muscular disc, which is distinctly marked off from ventral side of head except at its anterior edge; tentacles long, slender and acuminate, with a triangular flap just behind base of each; eyes just mesiad to bases of tentacles. Foot: lightly pigmented anteriad but shading into black at tip of tail; sole long and slender, acuminate and pointed posteriad, whitish with a dark median streak toward tip of tail.

Mantle collar (pl. XXIX, figs. 1–4): produced into a continuous shell fold, which is weakly bilobate on right but entire on left side, with large, radiating, pigmented blood-vessels (alternately afferent and efferent), so that it must function as an important aid in respiration; posterior and dextral regions of reflected edge very extensible, so as to reach apex of shell when fully expanded, with margin shallowly scalloped so as to form about fifteen semicircular projections, which usually contain masses of dark pigment; left region narrower and heavier with simple margin. Pneumostone: a little behind center of left (and broader) wall between mantle collar and diaphragm; two thirds surrounded, on side toward foot, by a high, pigmented fold, which forms a siphon. Lung (pl. XXIX, fig. 6): obliquely transverse with respect to long axis of foot; about one and one-half times as long as its base or length of kidney proper. Pericardium: slightly oblique to long axis of kidney; principal pulmonary veins three in number, one along columellar muscle, a second along columellar (right) margin of kidney, and a third along rectal (left) side of same; venation much weaker than that of mantle reflection. Kidney: consisting of three regions, a narrow pericardial duct, an expanded, lanceolate kidney proper with strong transverse trabeculae and a short orthureter; coelomostome near posterior end of pericardium; pericardial duct about two thirds as long as pericardium; kidney proper twice as long as its greatest width and two and one fourth times length of pericardium; orthureter about as long as pericardium; external ureteric opening near base of left margin of pneumostomatic lobe. Anus: near base of right margin of same lobe.

Ovotestis: imbedded in columellar side of liver; duct long, with numerous digitiform processes (seminal enlargements) near base. Albumen gland: shortly wedge-shaped, broader than long. Uterus (pl. XXIX, fig. 7): voluminous and sacculate. Free oviduct: short. Spermatheca: clavate and quite short; imbedded obliquely across columellar margin of lung so that tip is close to pericardium. Vagina: short. Prostate: long type, consisting of transverse lobes which are closely ap-

pressed along columellar side of uterus. Vas deferens: slender but thick-walled. Penis: vergic sac about as long as preputial but much more slender; without accessory glands. Penial protractors: short, consisting of one broad bifurcate band which inserts near middle of preputial sac and four slender ones with more anterior insertions. Penial retractor: origin from columellar muscle mass; bifurcate anteriad; larger division inserted near base of vergic sac; smaller branch again divides into vergic retractor and a slender band which attaches near larger division. Vergic sac: apical two thirds very slender with a slightly swollen apex; basal one third enlarged so as to approach diameter of preputial sac; basal half with an internal pilaster which is much enlarged in swollen anterior region; verge slender, acuminate and about two thirds the length of its sac. Preputial sac: larger and thick-walled; internally with coarse longitudinal folds; external orifice under triangular expansion at base of right tentacle.

Jaw: as in genus. Radula: chevron-shaped, broader than long; formula 165–1–165. Central (pl. XXIX, fig. 5): small and variable, completely covered by reflections of inner laterals; cusps extremely variable but a mesocone and two ectocones on each side are commonly present. Laterals: rastriform, with ectoanterior braces; first tooth small and variable; second to fifth increasing rapidly in size and in prominence of brace, cusps about 11 in number and subequal in size; majority of teeth with long braces and about seven principal cusps, the interspaces between which often develop single small interstitials.

The genitalia of *Aplexa rivalis* are quite similar to those of *A. hypnorum* (cf. Soos; 1917, Ann. Mus. Nat. Hungarici, v. 15), but, in the southern species, the enlargements of the hermaphroditic duct are longer and the prostate is better developed. The absence of accessory penial glands and the slender vergic sac of *A. rivalis* agrees with the conditions in *Aplexa* rather than with those in *Physa*. For these reasons, the subgenus *Stenophysa* is transferred from *Physa* to *Aplexa*, although the development of the mantle edge represents a somewhat intermediate condition.

Aplexa (*Stenophysa*) *panamensis* ("Muhlfeldt" Küster), and form *simoni* (Jousseaume)

1. *Physa panamensis* Anton (1839, Verz., p. 49), nude name; Küster (1844, p. 11, pl. 2, figs. 3–5), Panamá. *P. cornea* Preston (1907, Ann. Mag. Nat. Hist. (7)20, p. 497, fig. 20), Merida, Ven.

2. *P. simoni* Jouss. (1889, p. 253, pl. 9, figs. 3, 4), Laguna de Espino, near Carácas.

Frequent in a small spring near Estación Táchira (H, VI, c, 38). A.N.S.P. 98903: "cotypes" of *P. cornea* from Preston.

Although I am rather doubtful of the specific separation of *A. panamensis* and *A. rivalis*, the former seems quite well characterized by its stronger columellar fold and its more shouldered whorls. *P. cornea* appears to fall between *A. panamensis* and what I am calling form *simoni*, although the sculpture of Preston's shells is a little heavier than usual. The specimens collected near Estación Táchira represent a dwarfed form of the present species, which seems very close to Jousseaume's *simoni*, although his figure looks almost as much like the dwarfed form of *rivalis* that I have already mentioned.

	Dimensions				
Küst. (*panamensis*), text and fig.	16.7	47(7.8)	72(12.1)	47(5.7)	4(no!)
Preston (*cornea*), text..	11.5	52(6)	65(7.5)	40(3)	5½
A.N.S.P. 98093	9.1	55(5.05)	76(6.9)	42(2.95)	4¾
	8.5	58(4.95)	76(6.5)	49(3.15)	4½
H, VI, c, 38					
Means, 5 largest shells	5.4	55(3.0)	70(3.8)	47(1.8)	4.1
Minima, 5 largest shells	4.8	53(2.7)	69(3.35)	45(1.65)	4
Maxima, 5 largest shells	5.7	57(3.25)	72(4.15)	50(2.0)	4¼
Jouss. (*simoni*), text and fig.	5	52(2.5)	69(3.5)	52(1.8)	4½

**Aplexa* (*Stenophysa*) *acuminata* ("Gray" Sowerby)

P. acuminata Swby. (1873, Conch. Icon., pl. 3, fig. 23), Santo Domingo.

This West Indian species is apparently quite distinct.

Physa (*Physella?*) *cubensis* Pfeiffer, approaching form *jamaicensis* C. B. Adams

1. *P. cubensis* Pfr. (1839, p. 354), Cuba; Küster (1844, p. 22, pl. 3, figs. 17–19). *P. acuta* "Drap." Orb. (1841, p. 193), Cuba, Jamaica, Guadalupe, Martinique. *Aplecta orbignyi* Mazé (1883, J. de C. 31, p. 30), subst. *P. acuta* Orb., non Drap.; also Basse-Terre, Guadeloupe (no description).

2. *J. jamaicensis* C. B. A. (1851, Cont. 9, p. 174), Malvern, St. Elizabeth, Jamaica; "Mousson" Clessin (1885, Chemn., p. 291, pl. 42, fig. 7), Jamaica. *P. guadeloupensis* "Grateloup" Clessin (1885, p. 291, pl. 42, fig. 12), Guadeloupe (not of "Fischer" Mazé, 1883).

A.N.S.P. 21166: one shell that approaches the more elongate and cylindrical form (*jamaicensis*) of this species, which appears to occur with typical *cubensis* in many localities.

Dimensions

Pfr. (*cubensis*), text.....	12.8	63(8.0)	.....	.....	5
Küst. (*cubensis*), text and fig...	12.8	58(7.4)	65(8.3)	57(4.7)	5
C.B.A. (*jamaicensis*), text.....	12.2	52(6.3)	66(8.1)	.....	..
Küst. (*jamaicensis*), text and fig.	10.0	54(5.4)	67(6.7)	55(3.7)	5
Küst. (*guadeloupensis*), text and fig.	13.0	55(7.1)	68(8.8)	56(4.9)	6
A.N.S.P. 21166.....	9.5	58(5.5)	73(6.8)	48(3.3)	4½

**Physa* (*Physella?*) *marmorata* Guilding

P. marmorata Gldg. (1828, Zool. Jour. 3, p. 534), in ditches, St. Vincent. *P. ventricosa* "Gldg." Swby. (1873, pl. 9, fig. 74), St. Vincent.

This fourth West Indian species should be watched for in collections.

Planorbidæ

Probably none of the American species of this family belong in the genus *Planorbis* Müller (1774, Verm. II, p. 152), type by absolute tautonymy,[3] *P. carinatus* Müller (p. 157), from

[3] In the synonymy of his *P. carinatus*, Müller includes, without query, a word-for-word quotation of Linné's description of *Helix planorbis* and gives as reference "Lin. Syst. 662" (1767, Syst. Nat. XII, p. 1242,

Denmark. The anatomy of most of the South American Planorbidæ is still unknown, but an attempt is made here to arrange them tentatively under generic names. The following group-names will be used:

Helisoma Swainson (1840, T. Malac., p. 337), monotype *Planorbis bicarinatus* Say (1816, Nich. Encycl., pl. 1, fig. 4), from Delaware River, U. S. A.

Planorbula Haldeman (1840, Mon. Linn. N. A., pt. 1, suppl., p. 2), monotype (by substitution) *Planorbis armigerus* Say (1821, Journ. Acad. Nat. Sci. Philadelphia 2, p. 164), from Upper Missouri River, U. S. A.

Planorbina Haldeman (1843, pt. 6, p. 14), type designated by Dall (1905, L. F. w. Moll. Alaska, p. 84), *Planorbis olivaceus* Spix (1827, p. 26), from prov. Bahia, Brazil. (In Haldeman, the name was practically nude and contained no species.)

Taphius H. & A. Adams (1854, Gen. Rec. Moll. II, p. 262), monotype *P. andecolus* Orb. (1835, Mag. Zool., p. 26), from Lake Titicaca.

Drepanotrema Crosse et Fischer (1880, Moll. Mex. II, pp. 59, 75), type designated by Dall (1905, p. 86), *P. yzabalensis* C. & F. (1879, J. de C. 27, p. 342), type locality Lake Izabal, Guatemala.

Tropicorbis Brown and Pilsbry (1914, Proc. Acad. Nat. Sci. Philadelphia 66, p. 212), type by original designation, *P. liebmanni* Dunker (1850, Chemn. II, p. 59), from Vera Cruz, Mexico.

Helisoma (Planorbina) guadaloupense guadaloupense (Sowerby)

Planorbis guadaloupensis Swby. (1822, Gen. Shells, fig. 2), Jamaica. *P. guadelupensis* Mart. (1873, p. 195; in part), Carácas.

A.N.S.P. 21624 (Swift Coll.), Rio Yaracuy, Ven.; 121346 (Wheatley Coll.), Ven.; 121384 (Hugo Cuming), Venezuela.

The shape of the aperture of these specimens varies considerably; some have a well-rounded palatal margin as in typical *guadaloupensis*, but others have the slight angulation that is

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Test. no. 662). The objection that Müller (p. 161) may have been dubious (and in fact wrong) in the specific application of the name is not pertinent to the question: "Type by absolute tautonymy" is not governed by the rules provided for "cases in which the generic type is accepted not solely upon basis of original publication" (Art. 30, II). The recognition of Geoffrey (1767, Traité Coq. Paris, p. 12; non-binomial although post-Linnaean) as the authority for *Planorbis* leads to practically the same result.

supposed to be characteristic of *Planorbis olivaceus* "Spix" Wagner (1827, p. 26, pl. 18, figs. 1, 2), from near Ilheos and Almada, prov. Bahia, Brazil. The Brazilian specimens in the A.N.S.P. attain a larger size, however, than do those from the West Indies and northern South America, and *olivaceum* may be retained as a southern subspecies, although, as shown by the table of dimensions, some shells from Venezuela closely approach the size of Spix's type. Lot 121384 apparently came from Hugo Cuming and is labeled *P. cumingianus* from Venezuela; the shells have the eroded apex, but lack the deeply impressed suture on which *P. cumingianus* Dkr. (1850, p. 49, pl. 8, figs. 1–3), habitat unknown, was based.

	Dimensions				
	Shell		Aperture		Whorls
	altitude[4]	maj. diam.	min. diam.	altitude	diam.	
Sowerby (fig. 2)....		(26.8)				6
Wagner (*olivaceus*).		(32.4)		(7.8)		5(?)
Dkr. (*cumingianus*).	5.9	465(27.5)	425(25.0)	105(6.2)	170(10.4)	6
A.N.S.P. 21624						
Means, 5 shells...	6.3	446(28.0)	393(24.7)	118(7.4)	124(9.3)	dec.
Minima, 5 shells..	5.8	424(27.2)	376(23.9)	112(7.1)	122(9.0)	dec.
Maxima, 5 shells..	6.8	469(29.2)	412(25.6)	126(7.7)	131(9.5)	dec.
A.N.S.P. 121346						
Means, 4 shells...	5.5	437(24.0)	381(21.0)	117(6.4)	117(7.5)	dec.
Minima, 4 shells..	5.1	426(22.1)	364(19.2)	115(6.0)	108(6.7)	dec.
Maxima, 4 shells..	5.9	454(26.8)	398(23.5)	118(6.9)	129(8.9)	dec.
A.N.S.P. 121384						
Two shells.....	5.8	476(27.6)	417(24.2)	122(7.1)	120(8.4)	dec.
	6.4	453(29.0)	398(25.5)	113(7.2)	131(9.4)	dec.
Cl. (*moreletianus*)..	3.7	320(12.0)	300(11.2)	101(3.8)	145(5.5)	5

Helisoma (*Planorbina*) *guadaloupense lugubre* "Spix" Wagner

P. lugubris Wagner (1827, p. 26, pl. 18, figs. 3–6), from same locality as *P. olivaceus*. *P. guadelupensis* Mart. (1873, p. 195, small specimens), Venezuela.

[4] Altitude measured axially; i.e., aperture is not included. In many cases the dimensions quoted from earlier writers are combinations of those given in the text with the figure.

A.N.S.P. 21623 (F. R. Cocking), Carácas, Ven.

Although the original specimens of "Spix" apparently came from the same locality as his *olivaceus,* this variation appears, as suggested by Martens (*l.c.*), to be a dwarfed form which may usually be developed in separate localities. In addition to the small size, this form is less closely coiled than typical *guadaloupense* (or *olivaceum*).

		Dimensions				
Wagner (*lugubris*) ..		(23.4)		(7.8)		4(?)
A.N.S.P. 21623						
Three shells.	6.1	413(25.2)	356(21.7)	121(7.4)	109(8.1)	6
	6.2	382(23.7)	332(20.6)	113(7.0)	116(8.1)	5¾
	6.5	357(23.2)	309(20.1)	112(7.3)	110(8.0)	5¾

Helisoma (*Planorbina*) *bahiense* (Dunker)

P. bahiensis Dkr. (1850, p. 51, pl. 8, figs. 13–18), Bahia, Brazil. *P. lugubris* var.? Mart. (1873, p. 196, pl. 2, figs. 8, 9), Carácas.

A.N.S.P. 121350 (Wheatley Coll.), Venezuela.

Although Martens realized that *bahiensis* is the form with the flat-sided, funnel-shaped left side, he apparently tried to stretch *lugubris* to cover it. I am rather doubtful whether this is a distinct species from the preceding, as one lot in the A.N.S.P. (21629), from Brazil (J. S. Phillips), contains both *olivaceum* and *bahiense,* and more or less intermediate conditions do occur. The two shells labeled as from Venezuela are stained a bright, rusty color and are considerably larger than Dunker's types.

		Dimensions				
Dkr. (*bahiensis*)	5.5	365(20.1)	330(18.1)	140(7.6)	115(8.8)	5–6
A.N.S.P. 121350						
Two shells....	7.4	402(29.7)	347(25.7)	118(8.7)	124(10.8)	7¾
	7.7	351(27.7)	304(24.0)	119(9.4)	100(9.4)	7¼

Helisoma (*Planorbina*) *moreletianum* (Clessin)

P. moreletianus Clessin (1884, Chemn. II, p. 162, pl. 24, fig. 1), La Guaira, Ven.

I have seen no specimens, but the original figure and description look suspiciously like young examples of *H. guadaloupense*.

Helisoma (*Taphius*) *pronum* (Martens)

P. pronus Mart. (1873, p. 198, pl. 2, fig. 5), Lago de Valencia, Ven.

A.N.S.P. 85393 (Boyer and Shulze), Lago de Valencia.

Planorbula (*Tropicorbis*) *straminea* (Dunker)

P. stramineus Dkr. (1848, P. Z. S., p. 52), South America; Dkr. (1850, p. 42, pl. 5, figs. 7–9); Mart. (1873, p. 196, pl 2, fig. 6), Lagunilla, Carácas.

P. meridaensis Preston (1907, Ann. Mag. Nat. Hist. (7)20, p. 407, fig. 18), Merida.

A.N.S.P. 98195 (paratypes of *meridaensis*).

The main difference between *straminea* and *meridaensis* seems to be the extra half whorl of the former.

	Dimensions					
stramineus, (Dkr.)	3.6	310(11.1)	265(9.5)	130(4.6)	115(5.2)	4
meridaensis (Pr.)	2.7	300 (8.0)	.....	110(3.0)	(1.5)?	3½

Planorbula (*Tropicorbis*) *kühniana* ("Dunker" Clessin)

P. kühnerianus Clessin (1883, p. 108, pl. 11, fig. 12); *P. kühnianus* (1886, pp. 413, 429 and errata), Surinam.

Numerous specimens from pools in small streams (H, VIII, IX, b), lagoons (H, XI), and ponds (H, XII, XIII) at Bejuma (9, 10, 12) and Boquerón (25, 27a).

This species is considerably smaller than specimens of *P. straminea* with the same number of whorls. Both these species have more deeply impressed sutures and more evenly rounded whorls than *P. pallida*.

	Dimensions					
kühnianus Dkr....	2.1	310(6.5)	275(5.8)	105(2.2)	115(2.5)	4
H, XI, b, 12	2.0	320(6.4)	275(5.6)	120(2.4)	105(2.5)	4½

The jaw of *P. kühniana* is quite as in the family; the principal piece is arcuate, with numerous, ill-defined ribs; the lateral pieces are small and comma-shaped. The radular formula of a specimen from Bejuma (H, XII, 10) is: 13–6–1–19, with 106 transverse rows, which are markedly curved anteriad in the marginal fields. The symmetric central has a broad base with sloping sides and bears a heavy thickening with two large cusps. The five inner laterals are asymmetric, have broad bases and bear three large cusps, of which the entocone is biggest. Beyond this, the teeth become still more asymmetric and develop longer reflections; the entocone tends to break up into smaller cusplets, and accessory cusplets are added outside the ectocone, which occasionally also splits into two cusplets. The definitive marginal teeth have very short bases and long, oblique reflections, which may bear, along the outer side, as high as 5 entocones, 2 mesocones (usually only one), 2 ectocones and 5 accessory ectocones. The number of cusps is variable, even between adjacent teeth of the same longitudinal row. The outermost teeth are vestigial.

**Planorbula* (*Tropicorbis*) *pallida* (Adams)

P. pallidus C. B. A. (1846, Proc. Boston Soc. N. H. 2, p. 102), Jamaica; Clessin (1864, p. 122, pl. 11, fig. 7); H. B. B. (1924, this series, no. 162, p. 71), Dutch West Indies.

P. circumlineatus Shuttl. (1854, Mitt. naturf. Ges. Bern, p. 96), near Humaco, P. R.; Clessin (1884, p. 211, pl. 32, fig. 6); T. van Benthem-Jutting (1925, Bijd, Dierk, Amsterdam 24, p. 28, fig. 4), Curaçao. Probably not of Sowerby (1878, Conch. Icon., pl. 6, fig. 48).

P. terversianus Guppy (1866, A. M. N. H. (3)17, p. 47), Trinidad; not of Orbigny.

?*P. gundlachi* "Dkr." Clessin (1884, p. 146, pl. 17, fig. 8), Trinidad.

This species has not been reported from Venezuela, but a University of Michigan expedition found it in a pond in the

desert at Bolivar, Santa Marta, Colombia (Aug. 20, 1920) and it also occurs in Trinidad. Recently I have had the opportunity to examine C. B. Adam's collection, temporarily in the Univ. of Mich. Museum of Zoölogy. None of his specimens are indicated as the types, but all those labeled *P. pallidus* are the species outlined in the foregoing synonymy.

The jaw and radula of a specimen from the Colombian lot are very similar to those of *P. kühniana.* The radular formula (pl. XXVIII, fig. 8) is: 13–5–1–18; 106 rows counted.

Drepanotrema lucidum (Pfeiffer)

P. lucidus Pfr. (1839, Arch. Naturg. 5–1, p. 354), Cuba; Mart. (1873, p. 198), Carácas; Clessin (1884, p. 193, pl. 29, fig. 2).

P. lanierianus Orb. (1841, Moll. Cuba, p. 196, pl. 14, figs. 1–4), Habana, Cuba.

P. meniscus Guppy (1871, Amer. Journ. Conch. 6, p. 310), Chatham River, Erin., Trinidad.

?*P. surinamensis* "Dkr." Clessin (1884, p. 126, pl. 17, fig. 11), Jamaica and near Paramaribo, Surinam.

I did not obtain this species in Venezuela, but have examined a lot from a ditch, just off river, at Dunoon, British Guiana. The jaw is quite similar to that of *Planorbula kühniana,* but the radula is very different. The radular formula (pl. XXVIII, fig. 9) is: 28–1–28, with 242 transverse rows, which are almost straight. All the teeth are very much smaller than in *Tropicorbis.* The central has two small ectocones on either side of the two, long, aculeate cusps which, in the Planorbidæ and Ancylidæ, apparently correspond to the mesocone. The first lateral has two entocones and three entocones; all of the cusps are long and slender, quite unlike those in *Tropicorbis.* The transition between the laterals and the marginals is very gradual. The definitive marginals distinctly resemble those of *Ferrissia* (Ancylidae); they are relatively much shorter than in *Tropicorbis,* develop interstitial cusplets between the major cusps (instead of dividing them) and show as many as six accessory entocones.

This and the next three species are included in *Drepanotrema* on account of the close similarity between their radulæ

and that of *D. anatinum,* which certainly must be a member of the genus. All the species of *Drepanotrema,* as expanded here, have relatively weak growth-wrinkles and definite spiral striations. However, the form of *D. lucidum, D. ahenum* and *D. cimex* is most like the European group of *"Planorbis" vortex* (L.), for which no name is at present available. *Spiralina* "Hartmann" Martens (1899, Biol. C. A., p. 395), type designated by Lindholm (1922, Ann. Mus. Zool. 23, p. 320), *Helix vortex* L., is preoccupied by the still-born *Spiralina* "Hartmann" Herrmanssen (1847, Ind. Gen. Mal. II, p. 286), type *P. carinatus* Müller. Regardless of what Hartmann had planned for his nude name, Herrmanssen effectually clothed and simultaneously killed *"Spiralina"* when he included the term, without question, in the synonymy of *Planorbis.*

		Dimensions				
Pfr. (*lucidus*)	...	(6.7)	.....	(2.2)	.....	4
Guppy (*meniscus*)	...	(6)	.....	(1.5)	.....	5
Cl. (*surinamensis*)	1.5	433(6.5)	.....	.....	.....	4½
Orb. (*lanierianus*)	1.35	440(6)	390(5.3)	110(1.5)	120(1.8)	4

Drepanotrema ahenum, new species

Common in lagoons, savanna ponds and forest pools (H, XI, XII, XIII) at Bejuma (9, 10), Palma Sola (20), and Tucacas (30).

Shell (pl. XXX, figs. 2–4): medium in size, with right side almost flat and left one shallowly funicular, but with apical whorls on both sides deeply sunken; quite thin and translucent in texture, highly polished and dark copper-colored, usually with dark red deposit in sutures on both sides and often with spiral striations similarly marked. Whorls 4¾ (type) to 5. Early whorls: rapidly increasing in size, and investing each other much as in *D. anatinum;* with distinct and almost continuous impressed lines. Later whorls: weakly subangulate at about one third of the altitude of whorl from left side; gradually increasing in diameter and only slightly investing each

other; sutures scarcely impressed on either side; spiral striations weak and indistinct, unless marked by red deposit; growth-wrinkles low and rounded; last whorl slightly descending. Aperture: broadly lunate, inclined at an angle of about 45° to longitudinal axis of shell. Peristome: simple and sharp, arcuate near periphery and slightly emarginate near right suture.

	Dimensions				
H, XII, 9, type.	1.65	375(6.2)	325(5.4)	100(1.65)	118(1.95)	4¾

This species is superficially similar to *D. lucidum*, but has weaker growth-wrinkles, much more polished surface and very much shallower sutures. This last difference is correlated with the obliquely beveled attachment at the suture; this feature and the submergence of the earlier whorls distinctly approach the conditions in typical *Drepanotrema*.

The radula and jaw of *D. ahenum* are also much as in *D. lucidum*. The radular formula is 30–1–30, with 194 transverse rows. The marginal teeth are slightly broader at the tip of the cusped reflection and may develop two interstitials between the entocone and mesocone.

Drepanotrema cimex cimex (Moricand)

Planorbis cimex Moricand (1839, Mém. soc. phys. Génève 8, p. 143, pl. 3, figs. 8, 9), Bahia, Brazil; Dunker (1850, p. 61, pl. 10, figs. 15–18); Mart. (1873, p. 198), Carácas, Ven.

P. macnabianus C. B. Adams (1849, Cont. 3, p. 43), Jamaica; Clessin (1884, p. 146, pl. 11, fig. 5).

Drepanotrema cimex pistiæ, new subspecies

Three specimens from a lagoon near Tucacas (H, XI, 30).

Shell (pl. XXX, fig. 1): smaller than typical *cimex;* type with left side distinctly convex and right evenly concave; thin, transparent and dull, brownish horn-colored. Whorls: 6½; subangulate nearer left than right side; suture deeply impressed; growth lines fine and closely spaced, crossed by

numerous, weak, but almost continuous, spiral striæ. Aperture: oblique; peristome simple and sharp.

		Dimensions				
Moricand (*cimex*)	.77	780(6)	725(5.6)	110(.86)	175(1.5)	6
Adams (*macnabianus*)	..	(6.8)	(6.3)	(.76)	.....	6
Type, *pistiae*	.87	505(4.4)	455(3.95)	71(.62)	185(1.16)	6½

For the same number of whorls, this subspecies is much smaller than typical *cimex*, either from Brazil or the West Indies. In addition, the convexity of its left side gives the type shell a very distinctive appearance, but the left side is flat in the two juvenile specimens.

Drepanotrema cultratum (Orbigny)

Planorbis cultratus Orb. (1841, p. 196, pl. 14, figs. 5–8), Cuba or Martinique.

One specimen from a savanna pond near Bejuma (H, XII, 10).

The radula of a specimen from a pond in the desert at Bolivar, Santa Marta, Colombia (Aug. 20, 1920), is fundamentally similar to that of *D. lucidum*. The radular formula (pl. XXIX, fig. 8) is 19–1–19, with 156 transverse rows. The central has four cusps instead of six and the marginals are somewhat shorter, with broader reflections, and develop as many as three interstitials between entocone and mesocone. The major difference is the smaller number of teeth.

		Dimensions				
Orb. (text and figs.)	1.15	775(9)	715(8.3)	111(1.3)	190(2.45)	6
H, XII, 10	.79	660(5.2)	590(4.68)	95(.75)	195(1.55)	5

Drepanotrema anatinum (Orbigny)

Planorbis anatinus Orb. (1835, Mag. Zool., p. 28; Voy. Amer. Mer., p. 351, pl. 45, figs. 17–20), stomach of duck killed near Bajada, Rio Parana, prov. Entre Rios, Argentine.

Common in pools of small streams (H, VI, VIII, IX) and savanna ponds (XII), at Bejuma (9, 10, 12, 13) and Boquerón (28, 26a, 27a).

These specimens agree quite closely with d'Orbigny's original description; since ducks are migratory birds, the actual type locality of this species is, of course, unknown. The spiral sculpture of *D. anatinum* is broken into series of minute, elliptical pits.

Dimensions

Orb. (text and figs.) . .	.81	250(2)	225(1.8)	104(.85)	97(.83)	3
H, IX, b, 12 (adult) . .	1.34	250(3.4)	227(3.05)	101(1.36)	92(1.25)	4½

The radula of this species is much like that of *D. cultratum*, but the teeth are still smaller; the formula is 18–1–18, with 158 transverse rows.

Ancylidæ

The Ancylidæ collected are being studied by Dr. Bryant Walker.

Sphaeriidæ

**Eupera moquiniana* (Bourguignat)

?Cyclus modioliformis Anton (1837, Arch. Naturg. 3, p. 284), South America. *?Pisidium diaphanum* Haldeman (1841, Proc. Acad. Nat. Sci. Philadelphia 1, p. 53), Brazil?

Pisidium moquinianum Bgt. (1854, Rev. Zool. (2)6, p. 663, pl. 14, figs. 13–17), central South America. *Sphaerium modioliforme* Prime, in part (1862, Mon. Sp. Sphaerium, p. 14), Brazil (and Venezuela?) said to be founded on type of *diaphanum*, with *Cyclas striatella* "Fér.," *C. littoralis* "Fér." and *C. venezuelensis* "Prime," vested in synonymy.

This species is included here because it is the monotype of the genus, and has been cited from Venezuela. *Cyclas modioliformis* is one of those semi-mythological names, which are quite unidentifiable from the original description, but which are preserved by subsequent authors as convenient sepulchers for other conchologists' species. To judge from Anton's dimensions, he must have had a very much smaller

shell than the adults of the present species. *P. diaphanum* is even more briefly proposed, and Haldeman's dimensions differ widely from those given by Prime for what he supposed to be the type (now apparently lost), although the discrepancies would partially disappear if we assume that Haldeman wrote millimeter and meant one sixteenth of an inch. Prime himself evidently included, under Anton's name, both the Brazilian (*moquinianum*) and Venezuelan (*simoni*) forms. They may represent the same species, but Bourguignat's figure shows a more obliquely truncate posterior end (more like *E. meridionalis*) than do any of the Venezuelan lots before me. I use *Eupera moquiniana* (Bgt.) for this species because it is the first name with a recognizable description and the only one with a figure.

Dimensions

	Length	Height	Breadth
Anton (*modioliformis*), text.....	2.8	61(1.7)	
Hald. (*diaphanum*), text.....	5	70(3.5)	50(2.5)
Bgt. (*moquinianum*), text.....	7	71(5)	57(4)
Prime (*modioliforme*), text.....	7.9	61(4.8)	50(3.95)

Eupera simoni (Jousseaume)

Sphaerium modioliforme Prime, in part (l. c.) Venezuela. ?*Cyclas bahiensis* Mart. (1873, p. 212, pl. 2, figs. 14), Carácas; not Spix (1827). *Limosina simoni* Jouss. (1889, p. 26, pl. 9, figs. 22, 23), Laguna de Espino, Carácas.

Immature specimens from a pond near Bejuma (H, XII, 10) and a larger shell from Palma Sola (H, XIII, 20). A.N.S.P.: (Swift Coll.), labeled *S. modioliforme*, from Puerto Cabello; (Schaufuss), labeled *S. subquadrandulum* Dkr., from Venezuela; (C. F. Starke), not identified, from Puerto Cabello.

I quite agree with Jousseaume's remarks as to the incorrectness of Marten's figure as an example of Spix's species (see below), and am doubtful just what it does represent,

since it appears more elongate and has much narrower beaks than *E. simoni.* I suspect, however, that Jousseaume himself missed the cardinal tooth in the left valve of his specimens, and Laguna (p. 27) is a very remarkable misspelling of *Limosina.*

The lots before me contain two rather distinct forms: (1) typical *simoni,* with an almost straight ventral edge (the first two A.N.S.P. sets) and (2) another form, with a distinctly arched lower margin (my material and the last A.N.S.P. lot). Since other species of the genus seem to be rather variable in this respect, and the hinge-armature is the same in both, I regard them as the same species. Worn specimens of *E. simoni* (either form) have very indistinct growth lines, but in my fresh material these are accentuated by delicate, close-set, epidermal riblets, which are wavy in dry specimens and give the shell a peculiarly rough and dull appearance. Vestiges of these are visible in specimens of *E. meridionalis* and other species of the genus. The groups of small spots in the shell substance of *E. simoni* are dark purple in color and are only visible externally in specimens of which the epidermis is worn thin.

Dimensions

Jouss. (*simoni*), text.....	7	71(5)	46(3.25)
Mart. (*bahiensis*), text.....	6	67(4)	
H, XIII, 20.....	6.4	72(4.6)	50(3.2)
A.N.S.P. (Schaufuss).....	4.9	75(3.7)	55(2.7)
A.N.S.P. (Starke), largest.....	5.6	75(4.2)	55(3.1)

Because Jousseaume's description of the hinge armature is unlike that in any species of the genus, I offer the following emendations. Hinge: very narrow at cardinals but deepening towards laterals. Laterals: quite heavy; paired in right valve, single in left; right anterior tooth of left valve triangular, short but high; posterior one much longer but lower; ventral teeth of right valve similar to those of left; dorsal ones much lower and more slender. Left cardinal: consisting of slightly

oblique ridge about four times as long as least depth of hinge, with its posterior end thickened to form base of a wedge-shaped, horizontal lamella, of which tip is about as long as depth of hinge and which is situated just anterior to apex of umbones. Right cardinal: consisting of a low, crescentic ridge, which lies above and is thickened posterior to a notch, in ventral edge of hinge, which receives tooth of left valve.

**Eupera bahiensis* ("Spix" Wagner)

1. *Cyclas bahiensis* Wagn. (1827, Test. Bras., p. 32, pl. 25, figs. 5, 6), Peruguaçú River, Bahia, Brazil. ?*Limosina bahiensis* Clessin (1879, Chemn. II, p. 245, pl. 45, figs. 4, 5).

2. *Sphaerium bahiense* Prime (1862, p. 14; 1865, Smith. Misc. Coll. 145, p. 53, fig. 52), Bahia, Brazil. *Limosina tumida* Clessin (1879, p. 246, pl. 46, figs. 5–8), Bahia, Brazil.

This species is discussed here because it is the genotype of *Limosina* Clessin (1872, p. 160), by subsequent designation of Clessin himself (1874, p. 5), and has been incorrectly cited from Venezuela (see *E. simoni*). The original description calls for a deep and tumid *Eupera* of medium size. I do not put much faith in Clessin's identification with it of a shell in his collection, though he compared it with Spix's type; at any rate, his figure, like most of those in the "Cycladea," is worse than useless. On the other hand, the *bahiense* of Prime, and American collections, is a much smaller species of *Eupera,* which seems to be the *tumida* of Clessin. The collection of the Academy of Natural Sciences of Philadelphia contains three lots of this last species, one of which is labeled as from Bahia. Most of the specimens show by their heavy and

	Dimensions		
Wagn. (*bahiensis*), text.....	6.1	74(4.5)	69(4.5)
Clessin (*bahiensis*), text.....	6.5	77(5)	
Clessin (*tumida*), text.....	4.3	77(3.3)	58(2.5)
Prime (*bahiensis*) text.....	3.8	82(3.1)	61(2.3)
A.N.S.P., Brazil, largest.....	4.2	79(3.3)	60(2.5)

knobby hinge teeth and the prominent varices of their exteriors that they are fully mature or even senile specimens, and yet the largest is only two thirds the size called for by Spix's dimensions. *E. tumida* may be a dwarfed form of the true *E. bahiensis*, but no subsequent author seems to have matched Spix's original specimens very closely.

Eupera gravis, new species

Common in forest pool near Palma Sola (H, XIII, 20).

Shell (pl. XXXI, figs. 5–6): very shortly oval, tumid and quite heavy (for genus). Outlines: anterior end broadly rounded; posterior much higher and subtruncate; dorsal and ventral margins subequally convex. Beaks: full, almost central in position and projecting above valves. Epidermis: quite dull and dirty greenish yellow, with darker growth lines; thin and, in old specimens, easily peeled away; growth lines mostly weak and without epidermal ridgelets, but forming irregularly spaced, heavy varices, which become stronger in later half of growth. Shell substance: white and chalky, relatively thick and without pigmented inclusions. Hinge (pl. XXXI, figs. 1–4): quite heavy (for genus); ligament short but quite thick, mainly posterior to apex of umbones; cardinals single in each valve; laterals paired in right and single in left valve. Right cardinal: consisting of an oblique crescentic ridge just posterior to apex of umbone and culminating as a rather low triangular tooth; bordered below by a deep socket for reception of left tooth. Left cardinal: consisting of an oblique ridge, which culminates in a high and

		Dimensions	
E. insignis Pils., text ...	4	82(3.3)	62(2.5)
E. gravis, H, XIII, 20			
Type shell	4.7	86(4.05)	63(2.96)
Means, 6 largest	4.6	83(3.8)	59(2.7)
Extremes, ditto	4.5–4.7	79–86(3.7–4.0)	55–63(2.5–3.0)
One young shell	3.7	76(2.8)	49(1.8)

quite heavy, oblong lamella, with a deep groove above it for reception of right tooth. Left laterals: anterior one short and heavy, triangular in profile; posterior longer and lower. Right laterals: ventral ones almost as strong as in left valve; anterior dorsal much and posterior dorsal considerably weaker than other of pair.

The relatively heavy shell without colored inclusions and the thin epidermis with prominent varices of this species separate it immediately from any other member of the genus except *E. insignis* Pils. (1925, Proc. Acad. Nat. Sci. Philadelphia 77, p. 332), from Mexico, although *E. tumida* is somewhat similar in shape and usually develops some weaker varices. The less convex dorsal and ventral margins, high and more truncate posterior end and more centrally placed, lower beaks of *E. gravis* distinguish it from *E. insignis*. Young shells have even less convex margins, more truncate posterior ends and more elongate form than adults. Some specimens do not develop heavy varices until quite large, but even juveniles show widely spaced, weak ones.

Pisidium punctiferum (Guppy)

Cyclas punctifera Guppy (1867, An. Mg. Nat. Hist. (3)19, p. 160, text fig.), Trinidad. *Sphaerium punctiferum* Swby. (1876, Conch. Icon., pl. 4, fig. 40). *P. punctiferum* Clessin (1876, p. 74, pl. 8, figs. 7–8).

A.N.S.P. 59772, Puerto Cabello, Ven. (Schaufuss), labeled "*P. tamsiana* Dkr."; also four lots from Trinidad.

Guppy's original figure and description of the external appearance of this species are good, but those of Sowerby and Clessin are very poor. The "points," from which *P. punctiferum* derives its name, are actually spindle-shaped inclusions that run transversely in the shell substance. Guppy's formula for the hinge armature is incorrect, so I am offering the following emendations. Hinge (pl. XXX, figs. 5–7): not very heavy; ligament short and thick; more than half its length between beaks; cardinals single in right, double in left valve; laterals double in right, single in left. Right

cardinals: anterior tooth heavy but short, with a truncate, elliptical tip; posterior one a slightly curved lamella which is highest toward its posterior end. Left cardinal: a low and curved lamella, which is thickened rather abruptly at its posterior end but is not bifid; forming upper border of large but shallow socket for reception of right anterior tooth. Left laterals: not very high, with rounded and heavy tips; anterior one about one and one-half times as long as posterior. Right laterals: ventral ones similar to those of left valve but lower and weaker; dorsal ones very much shorter and more slender.

		Dimensions	
Guppy (*punctifera*), text	4	87(3.5)	62(2.5)
	3	83(2.5)	67(2)
A.N.S.P. 59772	3.7	85(3.15)	59(2.19)

Pisidum bejumæ, new species

One specimen from a savanna pond near Bejuma (H, XII, 10; type locality), and a smaller shell from Estación Táchira (H, VI, b, 35).

Shell (pl. XXXI, figs. 7–8): shortly ellipsoid, inflated, very thin and fragile. Outlines: anterior end quite narrowly rounded; posterior broadly rounded, almost subtruncate. Beaks: full and prominent, behind center of shell and projection well above valves. Epidermis: polished, pearl-colored, with very weak growth lines and a few very shallow sulci. Shell substance: thin, with numerous punctiform inclusions which usually show a rusty tinge. Hinge (pl. XXXI, figs. 9–10): very weak, not much heavier than margin of shell, but with full complement of teeth; ligament quite short and thin, with about half its length hidden between beaks. Right cardinals: anterior tooth a thin, but quite high, oblong lamella with its slightly convex ventral surface just beyond that of hinge; posterior tooth a very low pointed ridge close against ligament; intermediate sulcus (for reception of left tooth) very narrow. Left cardinal: a low lamella which curves

around above depression for right anterior tooth. Left laterals: remarkably slender; anterior one short and low; posterior one longer and quite high. Right laterals: ventral ones similar to those of left valve but still weaker; dorsal ones very small and narrow.

	Dimensions		
Type (H, XII, 10)	3.3	87(2.87)	69(2.26)

This species has much fuller and more prominent beaks, very much thinner shell, and weaker and shorter hinge than *P. punctiferum*. The hinge armature is even weaker and the teeth more slender than in *Eupera gravis*, although the full complement of a *Pisidium* is present.

Corbiculidæ

The following group-names affect the recent American species of this family:

Corbicula Megerle v. Mühlf. (1811, Mag. Ges. Naturf. Fr. Berlin 5, p. 56), monotype *Tellina fluminalis* Müll. (1774), from Euphrates River, w. Asia.

Cyrena Lam. (1818, Ann. s. vert. V, p. 551), type designated by Children (1823, p. 38), *C. cor* Lam. (1818, p. 552), without original locality; type designated by Kobelt (1880, Ill. Conch., p. 342), *C. ceylonica* (Chemn.) = *C. zeylanica* (Lam.; 1818, p. 554) = *Venus coaxans* Gmelin (1788, p. 3278), from Ceylon.

Cyanocyclas "Fér." Blainville (1818, Dict. sci. nat. XII, p. 280), proposed as substitute for *Corbicula* and taking same type; type designated by Dall (1903, Proc. Biol. Soc. Washington 16, p. 6), *Corbicula limosa* (Maton) = *Tellina limosa* M. (1809, Trans. L. S. London 10, p. 235), from South America.

Polymesoda Rafinesque (1820, Ann. Gen. Sci. Phys. Bruxelles 5, p. 319), monotype *Cyclas caroliniana* Bosc. (1801, Deterville ed. Buffon, Moll. III, p. 37), from Carolina.

Pseudocyrena Bourguignat (1854, Rev. Mag. Zool. (2)6, p. 82), monotype *Cyclas maritima* Orb. (1841, Sagra Cuba, Moll. I, p. 321), from Cuba.

Egeta H. & A. Adams (1858, Gen. Rec. Moll. II, p. 651), proposed as substitute for *Anomala* Desh. (1854, Proc. Zool. Soc. 22, p. 20), not

Samouelle (1819) nor Stephens (1829); type by absolute tautonymy, *Cyrena anomala* Desh. (1854, p. 21), from Bay of Caraccas, Peru.

Egetaria Mörch (1861, Mal. Bl. 7, p. 194), monotype *Cyrena pullastra* Mörch (*l.c.*) from Realejo, Nicaragua.

Cyrenocapsa Fischer (1872, Ann. Lyc. Nat. Hist. N. Y. 10, p. 195), type designated by Kobelt (1880, p. 342), *Cyrena floridana* Conrad (1846, Proc. Acad. Nat. Sci. Philadelphia 3, p. 23), from Florida.

Leptosiphon Fischer (*l.c.*), type designated by Kobelt (*l.c.*), *Cyrena caroliniana* (Bosc.).

Neocorbicula Fischer (1887, Man. Conch., p. 1092), type by original designation, *Cyclas variegata* Orb. (1835, Mag. Zool., p. 44), from Parana drainage, South America (= *Tellina limosa* Maton?).

Neocyrena Fischer & Crosse (1894, Miss. Sci. Mex. II, p. 631), type now chosen, *Cyrena nicaraguana* Prime (1869, A. J. Conch. 5, p. 146), from Nicaragua.

Corbicula is thus the oldest name for the genus with elongate, striate laterals; *Cyrena* and *Cyanocyclas* are two of its synonyms. Children's choice of type for *Cyrena* is very unfortunate because this name, the best known in the family (usually called Cyrenidæ), has almost universally been used for the genus, and Old World subgenus, of what is here replaced by *Polymesoda*. *Neocorbicula* is used here as a subgenus of *Corbicula*, to include the American species (with long pallial sinus); as indicated above, Dall's use of *Cyanocyclas* for this group cannot be followed.

Polymesoda becomes the generic name for the group with shorter, simpler laterals and for the typical, American subgenus with long pallial sinus; *Leptosiphon* is an absolute synonym, but *Neocyrena* might be used as a section for the species with heavier, concentrically ridged shells. *Pseudocyrena*, with *Egeta* and *Cyrenocapsa* as probable synonyms, and *Egetaria* are subdivisions of *Polymesoda* which are not known from Venezuela. The correct name for the Old World subgenus (*Cyrena* s.s. of most authors), is *Geloina* Gray (1840, Syn. Br. Mus., ed. 42, p. 154, nude; 1842, ed. 44, p. 75, defined), type designated by Gray (1847, p. 184), *Cyr. zeylanica*.

Polymesoda arctata (Deshayes)

Cyrena arctata Desh. (1854, p. 20), Maracaibo; Prime (1865, p. 16, fig. 10); Mart. (1873, p. 211).

A.N.S.P. 54636; 54637 (Swift Coll.); 54639 (J. S. Phillips); 120530 (Wheatley Coll.) and 123098 (Wheatley Coll.); all from Maracaibo or Lago de Maracaibo.

Polymesoda zulia, new species

A.N.S.P. 54939 (T. Prime); four specimens, labeled "*C. arctata* Desh.," from Maracaibo; 120528 (Wheatley Coll.), one specimen, labeled "*P. arctata,*" without locality.

Shell (pls. XXXII and XXXIII, figs. C, F): elongate subtrigonal (elliptical except for beaks), scarcely subsolid, convex and usually without posterior ridge (two examples have a very weak one which forms a rounded angle on margin of shell); escutcheon scarcely distinguishable. Outlines: anterior end narrowly rounded; posterior slightly less so or even shortly subtruncate; dorsal margin very convex; ventral evenly arched. Beaks (eroded): distinctly in front of middle; quite small, but prominent and full. Exterior: epidermis quite thick and rough, dull, dark yellowish-brown, still darker at rest periods; growth-wrinkles irregular, scaly, low and closely spaced, not forming distinct, macroscopic ridges even at rest periods. Interior: bluish white, scarcely shining; stained with violet at ends, in muscle scars and, more lightly, in concentric zones of varied width; muscle scars superficial; pallial line light; sinus triangular but curved slightly ventrad, about four times as long as deep. Hinge: shallow and weak; ligament short but stout and protuberant. Cardinals: three in each valve, radiating from point just in front of umbonal apex; anterior two quite close, subequal, fairly stout but low, triangular in median outline and bifid (with radial sulcus); posterior one of right valve much smaller than others and simple, but not widely separated; posterior one of left valve widely separated from others and forming a very oblique ridge with a low point (sometimes almost obsolete) near ventroposterior end. Left laterals: unpaired; anterior one short and weak, triangular in profile, about as high as long; posterior slightly longer but still lower and much weaker. Right laterals: ven-

tral ones longer but more slender than those of left valve; dorsal ones short, very low, especially anterior one which is sometimes almost obsolete.

	Dimensions		
P. aequilatera (Desh.) Swby. (fig.)			
A.N.S.P. 125279	39.4	88(34.6)	64(25.3)
A.N.S.P. 54641	24.0	90(21.6)	60(14.4)
P. mexicana (Brod. & Swby.)			
B. & S. (text)	38	87(33)	63(24)
Prime (text)	32	88(28)	91(29)?
F. & C. (text)	32	78(25)	68(22)
P. zulia			
A.N.S.P. 54939 (type) ..	31.4	84(26.4)	62(19.4)
Ditto; three others	33.4	78(26.0)	57(19.0)
	27.9	80(22.3)	60(16.7)
	24.5	82(20.2)	59(14.5)
A.N.S.P. 120528	28.0	82(23.0)	64(17.9)

P. zulia appears to be quite closely related to *C. mexicana* Broderip & Sowerby (1829, Zool. Journ. 4, p. 364), from Mazatlan, Mexico, and to *C. aequilatera* Deshayes (1854, p. 20), also known as *C. aequilateralis* Desh. (1858), from Cayenne (rivulets). All three have shallow hinges with quite weak armature and lack the distinctly ridged surface of most American Polymesodæ.

P. aequilatera, which has been figured by Sowerby (1878, Conch. Icon. 20, pl. 19, fig. 114), seems the most distinct of the three, although it was included in the synonymy of *C. mexicana* by Prime. Two specimens in the Academy of Natural Sciences of Philadelphia do not have as prominent posterior ridges as those shown in Sowerby's figure, but appear to be this species: A.N.S.P. 125279 (Wheatley Coll.), from French Guyana (Marie) and 54641 (Swift Coll.), from Demerara. To judge from these data, *P. aequilatera* is more nearly equilateral than either of the others and has much longer, although very slender posterior laterals; in addition

it is usually more nearly circular in outline than, at least, *P. zulia.*

P. mexicana has been discussed by Prime (1865, p. 22, fig. 18), Sowerby (1878, pl. 19, fig. 110), Fischer et Crosse (1984, Miss. Sci. Mex. II, p. 637, pl. 70, figs. 7) and von Martens (1900, Biol. C. A., p. 548, pl. 42, figs. 1–3). I have seen no authentic specimens, but it seems to develop a heavier hinge than either of the other species and its posterior laterals are heavier and more elongate than those in *P. zulia,* although shorter than those in *P. aequilatera.* It appears to be quite variable in form, but is typically higher and more nearly equilateral than *P. zulia.*

P. zulia agrees rather closely in shape with some specimens which have been identified as *P. mexicana* (cf. F. & C., locality?), but has weaker and shorter posterior laterals; the divergence is especially notable in the anterior dorsal tooth of the right valve. Also it seems usually to have fuller beaks, less prominently striate epidermis, a more evenly convex ventral margin and a more highly colored (violet) interior.

Corbicula (*Neocorbicula*) *cuneata* (Jonas)

Cyrena cuneata Jonas (1844, Zeit. Mal. I, p. 186), Rio Orinoco; Mart. (1873, p. 311). *Corbicula cuneata* Prime (1865, p. 6, fig. 5).

A.N.S.P. 54949 (Wheatley Coll.), Rio Orinoco.

Mutelidæ

Tetraplodon stevensi, new species

A.N.S.P. 125531: four specimens and two odd valves from the Wheatley Collection, labeled "*C. crosseanus* Hidalgo," and collected by Dr. Stevens from Rio Yuruari (Essequibo drainage), Venezuela.

Shell (pls. XXXII, XXXIII, figs. B): subrhomboid, subsolid, compressed, with quite prominent and straight posterior ridge. Outlines: anterior end narrowly rounded; posterior arched beyond ligament and truncate; dorsal margin convex (although less so than in most species of genus); ventral

slightly so. Beaks: quite low and flattened dorsally; not much anterior to center. Exterior: epidermis thick, dark olive-green to brownish; radial costæ numerous, almost straight and flattened, tending to break up and anastomose into V-shaped ridges on both anterior and posterior slopes, and becoming weaker or disappearing near ventral margin; growth-wrinkles coarse, especially toward ventral edge. Interior: nacre pearly to bluish, roughened slightly by the radial plicæ; anterior adductor scar impressed; posterior superficial; prismatic zone narrow. Hinge: quite shallow; ligament short and only slightly protuberant externally. Right pseudocardinals: two, almost horizontal lamella; dorsal slender and low; ventral much heavier, higher, and usually broken into two accessory points posteriad. Left pseudocardinal: high and lamellar, usually with one accessory posterior point. Laterals: quite short, usually only one in right valve (one shell has a low accessory ventral ridge) and two in left; ventral side of right tooth and dorsal side of lower left one usually crossed by transverse ridges (absent in type).

	Dimensions		
Type	37.6	77(29.1)	56(20.9)
Means, 4 largest	35.3	78(27.7)	58(20.6)
Minima, largest	32.3	77(25.3)	56(18.7)
Maxima, largest	37.6	80(29.3)	61(21.6)
Means, 2 smallest	28.3	79(22.5)	56(15.8)

This species evidently falls in Simpson's (1914, Desc. Cat. Naiades, p. 1202) group of *T. multisulcatus,* although its outline is rather similar to *T. schombergianus* (Sowerby), which is probably also from the Essequibo drainage. It is nearest *T. crosseanus* (Hidalgo) in shape and sculpture, but has flatter, straighter costæ, which become irregular at the ends of the shell and scarcely crenulate the ventral margin. *T. stevensi* is possibly a dwarfed, small stream form of *T. schombergianus,* but has much sharper, simpler posterior

ridge and more regular plicæ than those shown by Sowerby (1869, Conch. Icon. XVII, pl. 1, fig. 3).

Prisodon syrmataphorus (Meuschen in Gronovius)

Mya syrmataphora Gron. (1781, Zooph. p. 260, named in expl. pl. 18, figs. 1, 2), "Habitat in fluminibus Guineae." *Hyria syrmatophora* Sowerby (1869, pl. 5, fig. 11). *Unio syrmatophorus* Mart. (1873, p. 210), Rio Orinoco. *P. syrmatophorus* Simps. (1914, p. 1218).

A.N.S.P. 125546 (Wheatley Coll.), Rio Orinoco.

This Venezuela specimen has prominent wings with concave anterior and posterior margins.

		Dimensions		
		Height to beak	Height to wing	
Gronovius (fig.) ...	71	50(35.5)	63(45)	.....
Mart. (text)	73	55(40)	.....	33(24)
A.N.S.P. 125546 ...	89.5	58(51.7)	74(66.3)	36(32.4)

Monocondylaea tamsiana Dunker

M. tamsiana Dkr. (1858, Mal. Bl. 5, p. 226), Rio Chirgua (a northern tributary of the Orinoco), Venezuela. *M. tamsana* Simps. (1914, p. 1392).

A.N.S.P. 129960: two specimens in the Swift Collection collected by Dr. Tams, unnamed but labeled "Rio Chiqua, Prov. Carabobo, Ven."

I have very little doubt but what these shells in the Academy of Natural Sciences of Philadelphia are part of the original lot from which this species was described. Since *M. tamsiana* was considered dubious by Simpson, it is redescribed below:

Shell (pls. XXXII, XXXIII, figs A): irregularly rhomboid, scarcely inflated; lower border of escutcheon distinct but posterior ridge hardly represented; side with very low indistinct, broad, radial swelling a little behind middle. Outlines: anterior and narrowly rounded; posterior obliquely truncate, weakly emarginate just above posteroventral point of escutch-

con; dorsal margin almost straight but oblique; ventral scarcely convex. Beaks (eroded): low, near end of anterior third of shell. Exterior: epidermis quite thin, light yellowish green with some indications of broad, darker rays; radial wrinkles mainly weak but accentuated unevenly at irregular intervals by epidermal threads which, with the similar growth threads, form a reticulate pattern; growth ridgelets stronger toward both ends. Interior: whitish to bluish, iridescent, with close and distinct, although shallow, radial striations; anterior adductor scar impressed; posterior much less so; prismatic zone quite broad and distinct; sinulus shallow. Hinge: quite weak; ligament medium in length. Right pseudocardinals: consisting of a short but low nodule, of triangular profile, just in front of umbonal apex, followed by a short, radial trough, and a lower posterior nodule. Left pseudocardinals: represented by a low thickening, which is triangular in profile, just behind umbonal apex, with a shallow cavity before and another behind it; anterior nodule (the strongest in most species) scarcely represented. Laterals: not developed.

Dimensions

Dunker (text)	50	60(30)	40(20)
A.N.S.P. 129960	45.2	61(27.5)	41(18.8)
	34.2	67(22.8)	41(14.0)

The sculpture of *M. tamsiana* is quite similar to that of *M. franciscana* (Moricand) as represented by Marshall (1925, *Proc.* U. S. Nat. Mus. 67, art. 4, pl. 1, fig. 2), although the reticulate threads appear to be stronger in the Venezuelan species. The general appearance of the exterior is quite similar to that of the typical group of the genus, even though the form is more elongate than usual. On the other hand, the hinge seems more like that of *Fossula*, with a distinct approach to the edentulous condition of *Anodontites*.

Anodontites tortilis (Lea)?

Andonta tortilis Lea (1852, Trans. Amer. Phil. Soc. 10, p. 291, pl. 28, fig. 54; Obs. V, p. 47), Carthagena, S. A. (Colombia). *Anodon tortilis* Swby. (1870, pl. 37, fig. 154). *Anodontites tortilis* Simpson (1914, p. 1417).

Anodonta luteola Lea (1858, Proc. Acad. Nat. Sci. Philadelphia 2, p. 118; 1860, Journ. 4, p. 267, pl. 43, fig. 147; Obs. VII, p. 85), isthmus of Darien (Panamá). *Anodon luteolus* Swby. (1870, pl. 33, fig. 132).

One worn and broken shell from El Caño Fraile near El Guayabo in valley of Rio Zulia (H, VIII, 45).

Although the condition of this lone specimen prevents its accurate identification, it is a heavier and higher shell than the next species, and has the more convex dorsal margin and the distinctly festooned epidermis of *A. tortilis*.

Anodontites infossus, new species

Frequently in gravelly shoals of Caño Minapam (H, VIII, a, 20), a tributary of Rio Aroa near Palma Sola; in places where surface water was flowing; also, living and dead, deeply buried in parts of the bed that were superficially dry at the time visited.

Shell (pls. XXXII, XXXIII, figs. E.): long rhomboid, quite thin and very fragile (usually breaking when dried), somewhat convex; ventral evenly curved; anterior end narrowly rounded; posterior higher and sloping obliquely from just behind ligament to posterior point of escutcheon, where it forms a slight projection. Beaks: near end of anterior third; small but moderately full and elevated; hooked so as to touch above hinge line. Exterior: epidermis silvery at beaks, shading into light olive-green toward ventral margin and still darker tints at ends of shell; sculpture similar to but much weaker than that usual in the *crispatus* group; growth lines mainly very weak, but produced into appressed, epidermal lamellæ on posterior slope, and, to a lesser extent, near ventral margin and anterior end. Interior: nacre thin, with purplish iridescence and with shallow but distinct radial striations; adductor scars scarcely impressed; pallial line

weak; sinulus shallow; prismatic border broad. Hinge: weak and almost straight; ligament quite long and exposed; lunule narrow but distinct.

	Dimensions		
A. tortilis (Lea), text	36	64(23)	35(12.7)
A. luteolus (Lea), text	43	65(28)	35(15.2)
A. tortilis (Simps.) text	70	67(47)	36(25)
H, VIII, 45	55.4	64(35.2)	33(18.4)
A. infossus (H, VIII, a, 20)			
Type	68.3	56(38.5)	31(20.9)
Means, 10 largest	65.7	56(37.2)	32(20.8)
Minima, 10 largest	61.5	50(34.6)	29(19.4)
Maxima, 10 largest	73.7	59(42.7)	33(22.5)

A. infossus appears to be quite closely related to *A. tortilis* and may be only a local form of that species, but is a more elongate shell with straighter hinge and much weaker sculpture. Although the festooned wrinkles of the group of *A. crispatus* are visible, under a lens, just below the beaks, most of the shell is weakly marked with radially arranged series of short, almost straight, horizontal lines. In shape, *A. infossus is* somewhat closer to *A. irisans* Marshall, but seems to be a much thinner and narrower shell with more prominent beaks, which are farther from the anterior end.

Anodontites irisans Marshall

A. irisans Marshall (1926, Proc. U. S. Nat. Mus. 69, art. 12, p. 10, pl. 2, figs. 3, 5, pl. 3, fig. 7), Venezuela.

Anodontites guanarensis Marshall

A. guanarensis Marshall (1927, Proc. U. S. N. M. 71, art. 6, p. 3, pl. 1, figs. 4-6), in a dried lagoon at Mata Verde, near Guanare, Portuguesa, Ven.

Anodontites pittieri Marshall

A. pittieri Marshall (1922, P. U. S. N. M. 61, art. 16, pl. 1, figs. 9, 11, pl. 2, figs. 9, 12, pl. 3, fig. 6), Guaremales, Ven. (where?)

	Dimensions		
A. irisans, text	70	56(39)	46(32)
A. guanarensis, text	54	56(30)	30(16)
A. pittieri, text	50	70(35)	34(17)

Anodontites aroanus, new species

Four specimens and one odd valve from the same locality as *A. infossus*.

Shell (pls. XXXII, XXXIII, figs. D): long ovate, subsolid and slightly convex; lower border of escutcheon just visible. Outlines: dorsal margin distinctly arched; ventral convex; anterior end narrowly rounded; posterior much higher and obliquely truncate down to high posterior point. Beaks: near end of anterior quarter; small, moderately full and slightly elevated. Exterior: epidermis dull silver at beaks but shading rapidly through light olive-green into brownish-olive (old shells, including type, stained chestnut-brown or darker); sculpture much as in *A. tortilis* (i.e., with distinctly festooned wrinkles); growth lines quite heavy throughout and distinctly corrugating posterior slope. Interior: nacre thicker than in *A. infossus* and more highly iridescent; with very close radial striations; anterior adductor scar distinctly impressed; posterior one less so; pallial line distinct; sinulus quite shallow; prismatic border fairly broad. Hinge: rather solid and well arched; shorter than in *A. infossus;* ligament quite long and almost completely immersed; lunule very narrow and indistinct.

	Dimensions		
Type, H, VIII, a, 20	58.0	67(38.7)	36(20.9)
Means, 5 specimens	60.5	65(39.4)	35(21.0)
Minima, 5 specimens	53.5	62(35.5)	33(18.8)
Maxima, 5 specimens	64.2	67(42.3)	36(22.4)

The almost completely hidden ligament of this species evidently places it in Simpson's (1914, p. 1423) group of *A. in-*

aequivalvis (Lea), and, in fact, it resembles the Central American species more than it does the Colombian *A. trautwinianus* (Lea). *A. aroanus* seems closest to *A. pittieri* Marshall, but is plainly a more elongate shell, with its beaks nearer the anterior end, and has a narrower prismatic border.

Anodontites sp?

A.N.S.P. 85328: obtained from H. Ward, labeled "N. Venezuela?"

This large (164 mm. long) and quite solid left valve evidently belongs to Simpson's (1914, p. 1428) group of *A. trapezialis*, but does not agree exactly with any of the known species. On account of its worn condition, broken margin, and dubious locality, it seems better not to give it a specific name.

Anodontites (*Virgula*) *falsus* (Simpson)

Glabaris falsus Simps. (1900, Proc. U. S. N. M. 22, p. 932), Rio Yuruari, Ven. (Essequibo, not Orinoco drainage!). *A. falsus* Simps. (1914, p. 1456).

Mycetopoda pittieri Marshall

M. pittieri Marshall (1927, p. 4, pl. 2), in a dried lagoon at Mata Verde, near Guanare, Portuguesa, Ven.

Localities

During the preparation of this series, considerable time has been spent in attempts to ascertain the location of places cited by previous writers. In order to save future workers some of this trouble, a list of Venezuelan localities from which mollusks have been reported is appended. In parentheses after each, the state and the north latitude and west longitude have been added. Most of the larger places have been located in The Times Survey Atlas of the World (1922, London); the smaller features and the true boundaries of the states are from the Atlas of Venezuela (1916–20, editado por Vicente Lecuna). Unfortunately these two authorities disagree by as much as 20 minutes in the location of the same place; for this reason, T is placed before the latitudes taken from the former, and A before those from the latter.

Another difficulty comes from the numerous repetitions of the same name in different parts of Venezuela; this is especially true of the towns named after some patron saint. Also the rios, which in Spanish-American countries may mean a stream of almost any size, often change their names in different districts; for example, Rio Piña, Rio Nirgua, and Rio Burria are the same stream. Two other terms are often employed for water-courses in Venezuela: a quebrada is a broken, steep-sided mountain valley, with or without a small stream; a caño is a lowland water-course of slight gradient, so that it is often a series of stagnant pools or swamps during the dry season. Also on account of the prevalent illiteracy in Venezuela, the spelling of the terms varies a great deal, especially since *b* and *v*, *g*, *j* and *x*, and *z* and *c* are more or less interchangeable in Spanish.

Agua de Obispo (Trujillo; A 9° 41′, 70° 16′).

Aguirre, Rio (see Bejuma).

Angostura (see Ciudad Bolivar).

Aragua de Barcelona (Anzoategui; T 9° 29′, 64° 49′).

Aroa (Yaracuy; T 10° 31′, 69° 10′). The Aroa Mountains are a small range that appear to be separate from the Cumbres. Aroa (collected March 12–14) is a small town on a tributary of the Rio Aroa at the edge of the mountains. Most of the immediate vicinity is very barren and the humus of the near-by mountains is badly leached. The best locality for snails is along a small quebrada (station 23) west of town, where small cliffs with calcareous seepage formed a good habitat for land mollusks. Station 24 is along the mountain streams above the copper mines of Aroa.

Aroa, Rio (also runs past Boquerón and Palma Sola).

Arva (misspelling of Aroa).

Asunción, Island Margarita (Nueva Esparta; T 11° 21′, 63° 53′).

Barcelona (Anzoategui; T 10° 11′, 64° 45′).

Barinas (Zamora; T 8° 8′, 70°).

Barquisimeto, also Barquisimento, Barquisimeto (Lara; T 9° 58′, 69° 13′).

Barrancas (Monagas; T 8° 25′, 62° 25′).

Baruta, also Barruta (Miranda; A 10° 27′, 66° 50′).

Bejuma (Carabobo; A 10° 11′, 68° 13′). The Bejuma valley (collected Feb. 13–19, 24) and the surrounding ridges have been converted by repeated burning into very barren savannas (station 8), but the mountain streams in the ridge east of town (Banco Largo, station 7) retain narrow borders of low forest. Rio Bejuma (station 12) is a creek that flows through the town; most of the fresh-water shells come from small ponds in its bed. The Laguna de Ramón Coronel (station 9) is a rather rich, savanna lagoon east of town near the foot hills. It is choked with *Eichhornia*, reeds, and other aquatic plants. Station 10 consists mainly of the swamps along the Rio Aguirre, near the point at which this small stream is crossed by the road three kilometers out of Bejuma on the way to Aguirre. All these valleys drain into the Orinoco (see La Mona for stations 13 to 15).

Boquerón (Yaracuy; A 10° 36′, 68° 50′). This is an experimental farm of the Aroa Railroad (68.5 kilometers from Tucacas), where we were hospitably entertained (March 15–21) by General Elias Torres Aular. The woods in the vicinity (station 27) are better drained and drier than those around Palma Sola. The Rio Aroa is here a small and barren river with high, steep banks; station 25 includes mainly seepage pools at the base of these. Quebrada Cobre (station 26a) is an intermittent brook about four kilometers southeast by south from Boquerón, between the Rio Aroa and Quebrada Carabobo, of which Quebrada Vaca (station 26) is a small tributary. Rio Yumarito at the place collected (station 27a) is a creek which runs in the opposite direction, and becomes a stream almost as large as the Aroa (during the dry season) a few kilometers below the station. The Cerritos de Yumarito at Quebrada Seca (station 28) are small hills several kilometers southwest of Boquerón beyond the Rio Yumarito; here the better drainage encourages a richer molluscan fauna. Quebrada Sucremo (station 29) is a small spring brook in the heavy lowland forest beyond the Rio Yumarito and four or

five kilometers northwest of Boquerón. This last brook consists of very mucky and barren pools, which alternate with shallow rapids that are paved by dead shells of *Cercimelania*, covered with calcareous concretions.

Bolivar, Ciudad (Bolivar; T 8° 8′, 63° 55′); also called Angostura, which was formerly nearer the mouth of the Orinoco.

Brienco (?).

Carácas (Distrito Federal; T 10° 30′, 66° 53′); as a cited locality, it undoubtedly covers most of Venezuela.

Carácas Islands (Sucre; A 10° 22′, 64° 23′).

Cariaco (Sucre; T 10° 30′, 63° 40′).

Cariaquito, Ensenada (Sucre; A 10° 40′, 61° 51′); a bay near tip on south side of Paria peninsula; misspelled Cariaquita by Vanatta and myself.

Caribe, Rio (Sucre; T. 10° 42′, 63° 5′); possibly some of the citations of Caripe refer to this town on the north side of the Paria peninsula.

Caripe (Monagas; A 10° 9′, 63° 27′); on the Rio Caripe, near Cueva del Guacharo, in the drainage system of Rio San Juan (Gulf of Paria).

Caripe Mts.; probably those in vicinity of town.

Carupano (Sucre; T 10° 40′, 63° 18′).

Catatumbo, Rio (Zulia); my station 34 (A 9° 21′, 71° 41′) is on the north mouth.

Chachopo (Merida; A 8° 57′, 70° 45′).

Chichiriviche (Falcón; A 10° 56′, 67° 54′; also Distrito Federal: A 10° 35′, 67° 11′).

Chino, El (Yaracuy; A 10° 38′, 68° 31′).

Chirgua, Rio (see La Mona).

Claro, Rio (Bolivar; A 7° 58′, 63° 11′); a tributary of Rio Caroni.

Coast Range or *Caribbean System*: the mountains that run from near the Aroa range eastward to the end of the Paria Peninsula.

Colombia, Columbia; used by older writers as New Granada (which see).

Coro (Falcón; T 11° 28′, 69° 45′).

Cumaná (Sucre: T 10° 26′, 65° 14′).

Cumbres or Cumbre Mts.: the coast range behind Puerto Cabello; La Cumbre Peak is directly south of that town. Sometimes used for the western part of the Coast Range, west of Anzoategui.

Curiana; probably a misspelling of Cumaná.

Egido, also spelled Ejido (Merida; A 8° 32′, 71° 12′).

Encontrados (Zulia; T 9° 10′, 72° 34′); near the junction of Rios Zulia and Catatumbo. My station 46 is a series of ponds and swampy flats behind the raised banks of the latter river, about one kilometer northwest of town.

Estación Táchira (Táchira; A 8° 8′, 72° 13′). This is a small village in the foot-hills of the Cordillera Oriental, which in 1920 (visited April 4–8) was the terminus of the "Gran Ferrocarril de Táchira," about 113 kilometers from its other end at Encontrados. The town lies on a spur, high above the junction of the deep, canyon-like valleys of the Rios Lobaterita and Uracá. Most of the mollusks come from the valleys of these two streams, where the humus is naturally much richer than on the steep and rocky slopes. Station 35 is along a small brook on a flat a few kilometers above the town and near the left bank of the Rio Lobaterita. Station 38 is on a similar flat just west of and below the depot. Station 37 is a narrow, wooded point at the mouth of the Rio Uracá; station 36 is west of town on the same stream.

Galipán (?).

Guacharo, Cueva del, or Cave of Guacharos (Monagas; A 10° 8′, 63° 31′).

Guiguaza, Rio (Carabobo; A 10° 27′, 68°); along railroad between Puerto Cabello and Valencia.

Guanare (Portuguesa; T 8° 35′, 69° 30′).

Guanta (Anzoategui; T 10° 12′, 64° 40′).

Guaremales (?).

Guayabo, El (Zulia; A 8° 39′, 72° 15′). My station 45 is on El Caño Fraile, near Rio Zulia (collected by Mr. Jesse Williamson, April 24).

Güere, Rio (Anzoategui; A 9° 50′, 65° 5′).

Jaji (Merida; A 8° 34′, 71° 20′); probably Jali (Martens) and Zaji are misspellings.

La Guaira, also La Guayra (Distrito Federal; T 10° 38′, 66° 54′). My station 1 (collected Jan. 30) is on the Rio Macuto, a mountain stream that flows through Macuto, a suburb. The mountains in this vicinity rise abruptly from the ocean, so that the usual strip of semidesert is very narrow.

La Fría (Táchira; A 8° 12′, 72° 11′). This is a small village near the place at which the Táchira railroad crosses Rio La Grita, 102 kilometers from Encontrados. The immediate vicinity is heavy, lowland forest (station 40), that is largely flooded in wet weather. (The spring rains began during our visit, April 10–23). Just east of town are the Cerritos de las Brujas, hills largely composed of porous, whitish sandstone and covered by a low forest, in which tree-ferns and palms are very conspicuous; the humus is poor and badly leached. The Caño de las Brujas (station 39) comes down through these hills, but disappears in its shady bed about a kilometer beyond. Station 43, between Quebrada Las Pipas and Rio Oropito, is on the north side of these same hills; both these creeks also die out a short distance from the hills. South of town and east of Rio La Grita, a series of hills, composed of less porous rock, develop quite a heavy forest. Station 41 is an abandoned hacienda that has practically reverted to natural forest, where the Camino Real (a cobblestone highway) crosses Quebrada La Fría, a brook about two kilometers south of the village. Station 42 is a kilometer farther south on Quebrada Santa Aguita (a creek). Station 44 is in the tombas (second growth brush) at the railroad bridge across Rio La Grita.

Laguna de Espino (near Carácas).

Laguna Urao (Merida; A 8° 31′, 71° 33′); this is probably Sowerby's locality.

Lagunella, probably a misspelling of Lagunilla (a pond); there are undoubtedly thousands of places in Venezuela with this local name.

Langunilla, of Martens, is probably a pond near Carácas.

Lagunillas (Merida; A 8° 29′, 71° 23′); as this is near Laguna Urao, I suspect it is Sowerby's "Lagunella."

Lagunillas (Zulia; T 10° 5′, 71° 5′); another town of that name.

La Mona, also called Caserio Silva (Carabobo; A 10° 8′, 67° 10′). This is an hacienda, about seven kilometers out on the road from Bejuma to Valencia. The immediate region is almost as barren as the country around Bejuma, although the rocky valley of Rio Chirgua (a small river) is sparsely wooded (station 14). Rio La Mona (station 13) is a small creek with patches of brush along its banks. Cerro Chiriguara (station 15) is the highest hill in the vicinity and is between La Mona and Bejuma. The summits of all these hills are bare of trees but are covered with bunch-grass (*Andropogon,* etc.). On the east slopes of this one, a deciduous forest with coffee plantations offers rather barren collecting (visited Feb. 20–22).

Las Quiguas (see San Estéban).

Macuto (see La Guaira).

Manamo, Rio: the northernmost distributary of the Orinoco; its mouth is at Pedernales (which see).

Manimo River, a misspelling of Manamo; I have not located El Buelta Triste.

Maturan, misspelling of *Maturin* (Monagas; T 9° 48′, 63° 11′); on Rio Guarapiche.

Maracaibo (Zulia; T 10° 37′, 71° 41′); probably very few land snails come from the surrounding semidesert.

Margarita Island (Nueva Esparta; T 11° 64′).

Merida (Merida; T 8° 16′, 71° 5′); probably the citations cover most of the Sierra de Merida, which is the Venezuelan continuation of the Cordillera Oriental, although separated from it by lower hills (about 1,700 meters) between the headwaters of the Rio Grita and Rio Uribante (Catatumbo and Orinoco drainages).

Miranda (Carabobo; A 10° 9′, 68° 22′); drainage into Orinoco.

Montalbán (Carabobo; T 10° 13′, 68° 16′).

Neveri, Rio (Anzoategui; A 10° 8′, 64° 31′).

New Granada or New Grenada; included Venezuela, Colombia, Panamá, and Ecuador.

Nirgua (Yaracuy; T 9° 54′, 68° 36′). My station 17 is near the summit of the wooded ridge, La Chapa, which lies a few kilometers north of town; station 18 is a creek, Rio Piña, which furnishes its water-supply; station 19 includes Rio Nirgua and the very barren savannas near town. This valley drains into the Orinoco (visited Feb. 26–29).

Palma Sola (Yaracuy; A 10° 38′, 68° 31′). This is the junction between the San Felipe branch and the main line of the Aroa railroad. It is surrounded by lowland forest (station 20). The abruptly excavated valley of Rio Aroa (station 21) is about half a kilometer south of town. Although, at the time visited (March 4–10), the level of the river was more than 20 feet below the adjacent flats, the entire region is a maze of interlacing flood-channels, some of which, like the Cañon Minapam, contain series of pools or even a stretch of visibly flowing water. Two or three kilometers south of town the railroad to San Felipe cuts across a series of low hills with drier and more open forest (station 22).

Pedernales (Territorio Delta Amacuro; 9° 57′, 62° 15′).

Puntas Palmas del Norte and del Sur (Points on Lago de Maracaibo, north and south of Maracaibo).

Puerto Cabello (Carabobo; T 10° 30′, 68° 3′); the immediate vicinity of the town is very barren; as a cited locality, it probably includes most of the states of Carabobo, Lara, and Yaracuy (see San Estéban).

Roraima, Mount (Bolivar; T 5° 10′, 60° 50′).

San Estéban (Carabobo; A 10° 26′, 67° 58′); this was the headquarters of C. F. Starke, whose son still lives there, and probably much of the material labeled Puerto Cabello came from this vicinity. The small town is about six kilometers south of Puerto Cabello, and lies in the beautifully wooded, steep-sided valley of Rio San Estéban (station 2). Quebrada Grande (station 3) is a rocky valley of a creek opposite and

two kilometers above the town. Station 4 is the east side of the main valley, which rises about 1,500 feet above the river. Station 5 is along Ravina de Las Palmas, a short, steep quebrada opposite the northern end of the village. Station 6 is about four kilometers up the Rio San Estéban, above and opposite the village of Las Quiguas, on the sides of the Cumbre Chiquito and just below the fog zone.

San Felipe (Yaracuy; 10° 22′, 68° 50′); near headwaters of Rio Yaracuy.

San Hilario (?).

Santa Ana, Santa Anna (see part III, p. 19, footnote, and part IV, p. 11, footnote).

Santa Ana (Anzoategui; A 9° 19′, 64° 34′); another possibility.

Santa Catalina (Terr. Delta Amacuro; 8° 20′, 62° 5′).

Seca, Quebrada (see Boquerón).

Tacarigua, Lago (sometimes used for Lago de Valencia).

Tacarigua, Laguna de (Miranda: A 10° 15′, 65° 48′).

Timotes (Merida; T 8° 31′, 70° 36′).

Tocuyo, three towns along river of same name: Tocuyo (Lara; A 9° 47′, 69° 45′), Rio Tocuyo (Lara; A 9° 52′, 69° 48′), and Tocuyo de la Costa (Falcón; T 9° 23′, 69° 38′).

Tovar (Merida; T 8° 9′, 71° 40′).

Trincheras, Las (Carabobo; A 10° 18′, 68° 17′).

Trujillo, Truxillo (Trujillo; T 8° 53′, 70° 16′).

Tucacas (Falcón; T 10° 56′, 68° 23′). In the vicinity of this little seacoast town (visited March 23–25), the semi-desert strip averages less than a kilometer in width. At its inner edge a zone of mimosae and other thorn-trees interdigitate with a low and rather open forest. Along the Aroa railroad, the richer flood-plains, like those around Palma Sola, reach to within 14 kilometers of the coast. Station 30 is a large lagoon, 4.5 kilometers inland, which is surrounded by a zone of thorny brush and is almost covered by a growth of *Pistia, Eichhornia,* and other floating plants. Station 31 is along the Rio Tuca, which is a small creek that provides the water-supply of the town. In the immediate vicinity of this

stream and in the near-by hills the forest is a little heavier than elsewhere in the region. A peculiar feature of these woods is the growth of bromeliads and similar plants, which are rooted on the ground at the seaward edges of the brush, but become aërophytes at ascending heights on the shrubs and trees farther inland.

Upata (Bolivar; T 7° 50′, 62° 45′); on divide between Orinoco and Essequibo drainages.

Vagre, Rio (Terr. Delta Amacuro; A 9° 55′, 62° 21′); one of the distributaries of Rio Manamo.

Valencia (Carabobo; T 10° 10′, 68° 8′).

Valencia, Lago de (Carabobo, Aragua; T 10° 10′, 67° 30′).

Valera (Trujillo; T 9°, 70° 30′).

Varinas (a phonetic variant of Barinas).

Yacua; misspelling of Yaquara, between Chino and San Felipe?

Yaracuy, Rio; also spelled Yaracui (Carabobo, Yaracuy; 10° 30′, 68° 25′).

Yaraqui, Rio (misspelling of preceding?).

Yucacas (misspelling of Tucacas).

Yuruán, Rio (Bolivar; 6° 50′, 61° 53′), a tributary of the next river.

Yuruari, Rio (Bolivar; 7°, 61° 33′); a name for the headwaters of Rio Cuyuni (Essequibo drainage).

Zaji (misspelling of Jaji).

Zulia, Rio (tributary of Rio Catatumbo at Encontrados).

Additions and Corrections to Previous Parts

Number 137, parts I and II

pp. 1–7 (pl. 1). See H. B. B. (1924, this series, no. 152) for changes.

pp. 9–11. See list of localities in present part.

pp. 13–15 (pl. 3). The sections of *Sericea* and *Analcadia* should be placed in the genus *Alcadia; Succincta* goes in *Helicina.*

p. 17, line 20. Change San Esteben to Bejuma.

p. 18, line 6. Change San Esteban to Bejuma.

p. 26, heading (pl. 2). Change *Tudora williamsoni* to *Licina* (*Choanopomops*) *williamsoni.*

p. 26, line 13. Change *B. hanleyana* to *B. leucopleura*; see part V, p. 27.

p. 27, species heading. Change *Tudora* to *Licina* (*Choanopomops*).

NUMBER 156, PART III

p. 3, line 8. Delete *labyrinthica.*

p. 4, fourth species heading (pl. 7). *R. bactricolus* is the type of the subgenus *Radioconus;* see H. B. B. (1927, Proc. Acad. Nat. Sci. Philadelphia 79, p. 231).

p. 5 (pl. 6). *R. ditzleri* is probably a member of the subgenus *Radioconus.*

pp. 9, 10 (pls. 6, 7). Change *Euconulus* to *Habroconus; H. ernsti* belongs in the subgenus *Ernstia;* see H. B. B. (1928, Proc. Acad. Nat. Sci. Philadelphia 80, pp. 11, 12).

pp. 12, 13 (pl. 6). Change *Pseudohyalina* to *Miradiscops.*

p. 14, top. Delete Streptaxidae; see part IV, p. 5.

p. 14, line 29. See H. B. B. (1928, Naut. 42, p. 127).

p. 15, line 3. See H. B. B. (*l. c.*).

p. 16, third paragraph. *Streptartemon* becomes the name of the South American group.

p. 18, R′ in key. Change *Odontartemon* to *Streptartemon.*

p. 18, after key. Insert heading *Systropiidae.*

p. 20, line 23. Add to synonymy: *Happia glaberrima* Thiele (1927, Abh. Senckenberg. Naturf. Ges. 40, p. 320, pl. 26, fig. 15), Venezuela.

p. 20, line 26. Change H, I, c, 7 to H, I, c, 6.

p. 24, line 29. Change vii–36 to viii–36.

p. 25, species heading. Change to *Miradiscops implicans.*

pp. 26–33 (pls. 8–10). Change *Scolodonta* to *Systrophia.* See H. B. B. (1928, Naut. 42, p. 125).

p. 34, line 20. Change *ammonoseras* to *ammonoceras.*

p. 36. Above *Rectartemon jessei,* insert heading Streptaxidae.

p. 36. Thiele (1927, p. 316, pl. 26, fig. 2) reports *R. jessei* from Carácas.

p. 38, line 29. Change *Scolodontia* (*Scolodonta*) to *Systrophia.*

p. 38, last line. Add to synonymy: *Artemon martensianus* Thiele (1927, p. 316, pl. 26, fig. 1), Carácas.

pp. 39–40 (pl. 10). Change *Odontartemon* to *Streptartemon.*

p. 44. See third addendum for preceding part.

NUMBER 167, PART IV

pp. 5, 6 (pl. 17). Change Scolodontidae to Systrophiidae and *Scolodonta* to *Systrophia.*

p. 6 (pl. 17). Change *Odontartemon* to *Streptartemon.*

p. 11, et seq. Change *T. santanaensis* to *T. venezuelensis.* As Pilsbry (1926, Proc. Acad. Nat. Sci. Philadelphia 78, p. 122) has doubted my identification of *Helix santanaensis,* this name may be safely disregarded as unrecognizable. After examination of the sculpture in fresh specimens of *Thysanophora* s. s., I believe that *T. rojasi* is the description of worn shells, *T. venezuelensis* agrees with fresh specimens, which are almost hirsute.

p. 13, second heading. Change *T. canalis* to *T. canalis cariacoensis* Pils. (1926, p. 79).

p. 15 (pl. 12). *Hojeda* is now regarded as a distinct genus. Cf. Pils. (1926, p. 119).

p. 25, heading near bottom. Change *Drypus* to *Dryptus.*

NUMBER 182, PART V

p. 34, first to third species headings. Change *Nenia* to *Neniastrum. Nenia H.* and A. Adams (1855) is clearly preoccupied by *Naenia* Stephens (1829, in Lepidoptera). Even in ancient times the goddess of funeral songs appears to have permitted either spelling of her name. Also, the subfamily name becomes Neniastrinae.

PLATE XXVII

Scales for radulae represent 50 microns (.05 mm.), that for animal, one millimeter; uppermost one is for fig. 1, next for fig. 2, third for fig. 3, and lowest for fig. 4.

FIG. 1. *Pachychilus laevissimus* (Rio Macuto, Ven.). Radula: central and teeth of right side, separated laterad. Marginals are turned outward

FIG. 2. *Doryssa consolidata* (Cuyuni River, British Guiana). Radula, as in fig. 1, but lateral more erect from base and laterals only slightly turned outward

FIG. 3. *Potamopyrgus* (*Pyrgophorus*) *parvulus* (Curaçao). Head and verge, viewed from dorsal side

FIG. 4. *P. parvulus* (Aruba). Radula: as in fig. 1, but first marginal turned inward and second outward

PLATE XXVII

PLATE XXVIII

Scales for shells and animals represent one millimeter; those of radulae, 50 microns, with exception of that for fig. 9 which shows 20 microns; those of radular hairlines (T), 250 microns; uppermost one is for fig. 3, second for fig. 8T, third for fig. 9T, fourth for figs. 1 and 2, fifth for fig 6, sixth for fig. 8, seventh for figs. 4 and 9, and lowest for fig. 5.

FIG. 1. *Potamopyrgus* (*Aroa*) *ernesti vivens* (Boquerón, Ven.). Type shell

FIG. 2. *P.* (*Aroa*) *putealis* (Estación Táchira, Ven.). Type shell

FIG. 3. *P.* (*Aroa*) *globulus*. Type shell

FIG. 4. *P. ernesti vivens*. Radula: central and lateral

FIG. 5. *P. putealis*. Radula: central

FIG. 6. *P. ernesti vivens*. Head and verge, viewed from dorsal side.

FIG. 7. *P. ernesti vivens*. External view of operculum

FIG. 8. *Planorbula* (*Tropicorbis*) *pallida* (Bolivar, Colombia). Radula: central, 1st, 7th, and 11th teeth. Hairline (T) at right shows shape of right half of transverse row, with positions of central, each 7th tooth and edge of ribbon indicated

FIG. 9. *Drepanotrema lucidum* (Dunoon, British Guiana). Radula: central, 1st, 7th, 14th, and 21st teeth. Hairline (T) as in fig. 8

PLATE XXVIII

PLATE XXIX

Scales for radular figures represent 20 microns; those for animals and shells, 5 mm.; uppermost one is for figs. 1–3, next for fig. 6, third for fig. 5, fourth for fig. 7, and lowest for fig. 8.

FIG. 1. *Aplexa* (*Stenophysa*) *rivalis rivalis* (Bejuma, Ven.). Ventral view of living animal with expanded mantle; prepared from sketches made in the field

FIG. 2. *A. rivalis.* Right view of shell with expanded mantle superimposed on it

FIG. 3. *A. rivalis.* Left view as in fig. 2

FIG. 4. *A. rivalis.* Three views of mantle edge with lappets in different states of expansion

FIG. 5. *A. rivalis.* Radula: central, first, 3rd and 122nd teeth, oriented only in respect to long axis of radula

FIG. 6. *A. rivalis.* Internal view of lung wall and mantle edge (below). Pneumostomatic funnel has been cut and its halves reflected

FIG. 7. *A. rivalis.* Terminations of genitalia; male and female openings marked

FIG. 8. *Drepanotrema cultratum* (Bolivar, Colombia). Radula: central and first lateral in natural relations but slightly separated; also 7th and 14th teeth

PLATE XXIX

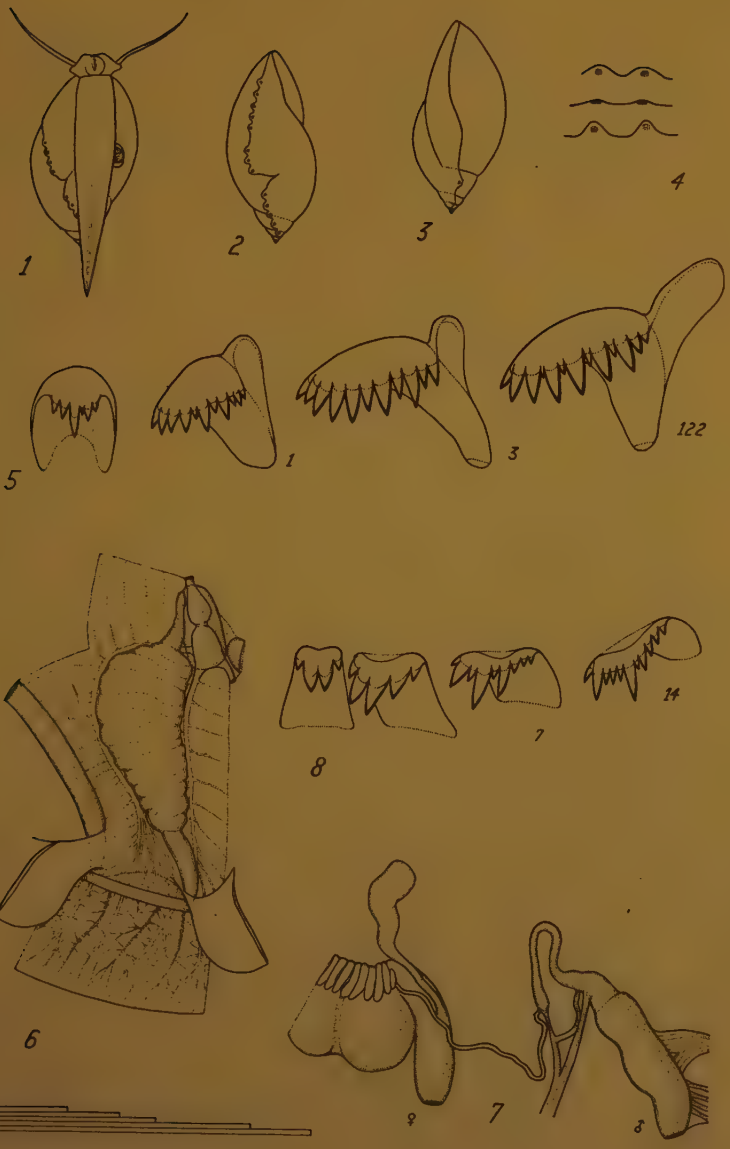

PLATE XXX

Uppermost scale is for fig. 8, next for figs. 2–4, third for fig. 1, and lowest for fig. 7; scale for fig. 8 represents 5 mm.; remainder, one millimeter.

FIG. 1. *Drepanotrema cimex pistiae.* Profile of type shell with left side uppermost

FIG. 2. *Drepanotrema ahenum.* Right side of type shell

FIG. 3. *D. ahenum.* Profile of type shell with right side uppermost

FIG. 4. *D. ahenum.* Left view of type shell

FIG. 5. *Pisidium punctiferum* (Puerto Cabello). Median view of hinge of right valve

FIG. 6. *P. punctiferum.* Obliquely ventral view of hinge from left valve, showing teeth in profile

FIG. 7. *P. punctiferum.* Median view of left valve

FIG. 8. *Pomacea* (*Effusa*) *glauca minuscula.* Profile of type shell

PLATE XXX

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6

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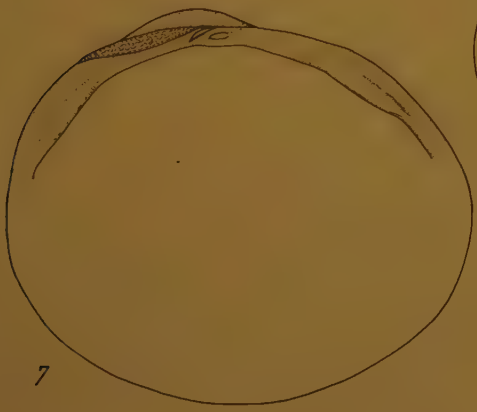

7

8

PLATE XXXI

Scales represent one millimeter; upper for figs. 5 and 6, lower for figs. 7 and 8.

FIG. 1. *Eupera gravis.* Median view of hinge armature in right valve of type

FIG. 2. *E. gravis.* Ventral view of right cardinal tooth

FIG. 3. *E. gravis.* Median view of hinge armature in left valve of type

FIG. 4. *E. gravis.* Ventral view of left cardinal tooth

FIG. 5. *E. gravis.* Right side of type shell

FIG. 6. *E. gravis.* Dorsal side of same

FIG. 7. *Pisidium bejumae.* Right side of type shell

FIG. 8. *P. bejumae.* Dorsal side of same

FIG. 9. *P. bejumae.* Ventral view of cardinal teeth in left valve

FIG. 10. *P. bejumae.* Median view of hinge armature in right valve

PLATE XXXI

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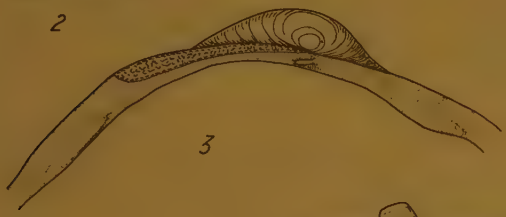

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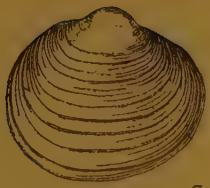
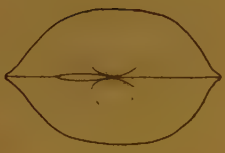


5



6

7

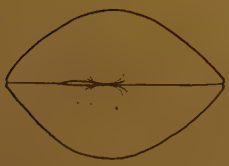


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PLATE XXXII

Figures are of approximately natural size; dimensions are given in text.

FIG. A. *Monocondylaea tamsiana* (Rio Chirgua, Ven.). Left side of paratype

FIG. B. *Tetraplodon stevensi* (Rio Yuruari, Ven.). Left side of type

FIG. C. *Polymesoda zulia* (Maracaibo, Ven.). Right side of an elongate paratype

FIG. D. *Anodontites aroanus* (Palma Sola, Ven.). Left side of type

FIG. E. *Anodontites infossus* (Palma Sola, Ven.). Left side of type

FIG. F. *Polymesoda zulia* (Maracaibo, Ven.). Left side of type

PLATE XXXII

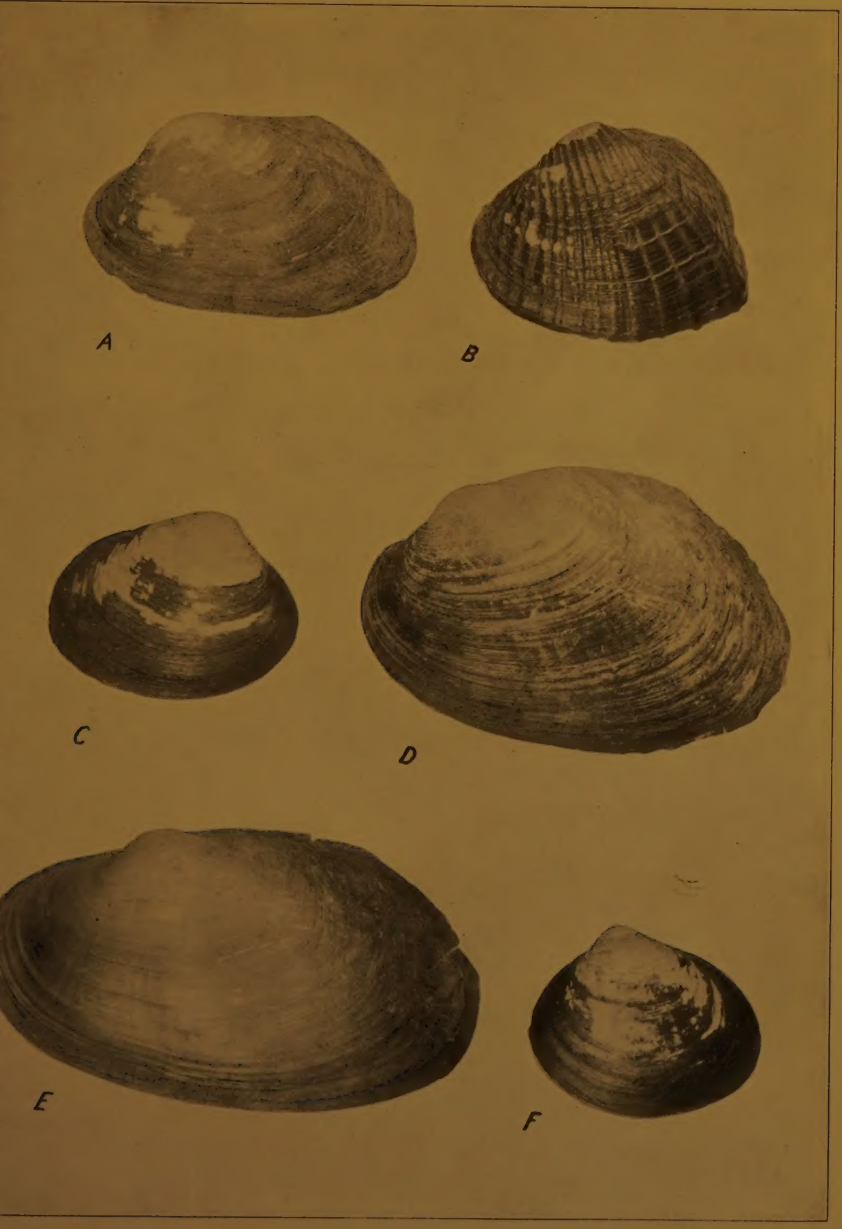

PLATE XXXIII

Figures are of approximately natural size; dimensions are given in text.

FIG. A. *Monocondylaea tamsiana* (Rio Chirgua, Ven.). Median view of right valve of paratype

FIG. B. *Tetraplodon stevensi* (Rio Uruari, Ven.). Same view of type

FIG. C. *Polymesoda zulia* (Maracaibo, Ven.). Median view of left valve of an elongate paratype

FIG. D. *Anodontites aroanus* (Palma Sola, Ven.). Median view of right valve of type

FIG. E. *Anodontites infossus* (Palma Sola, Ven.). Same view as fig. D.

FIG. F. *Polymesoda zulia* (Maracaibo, Ven.). Same view as fig. D.
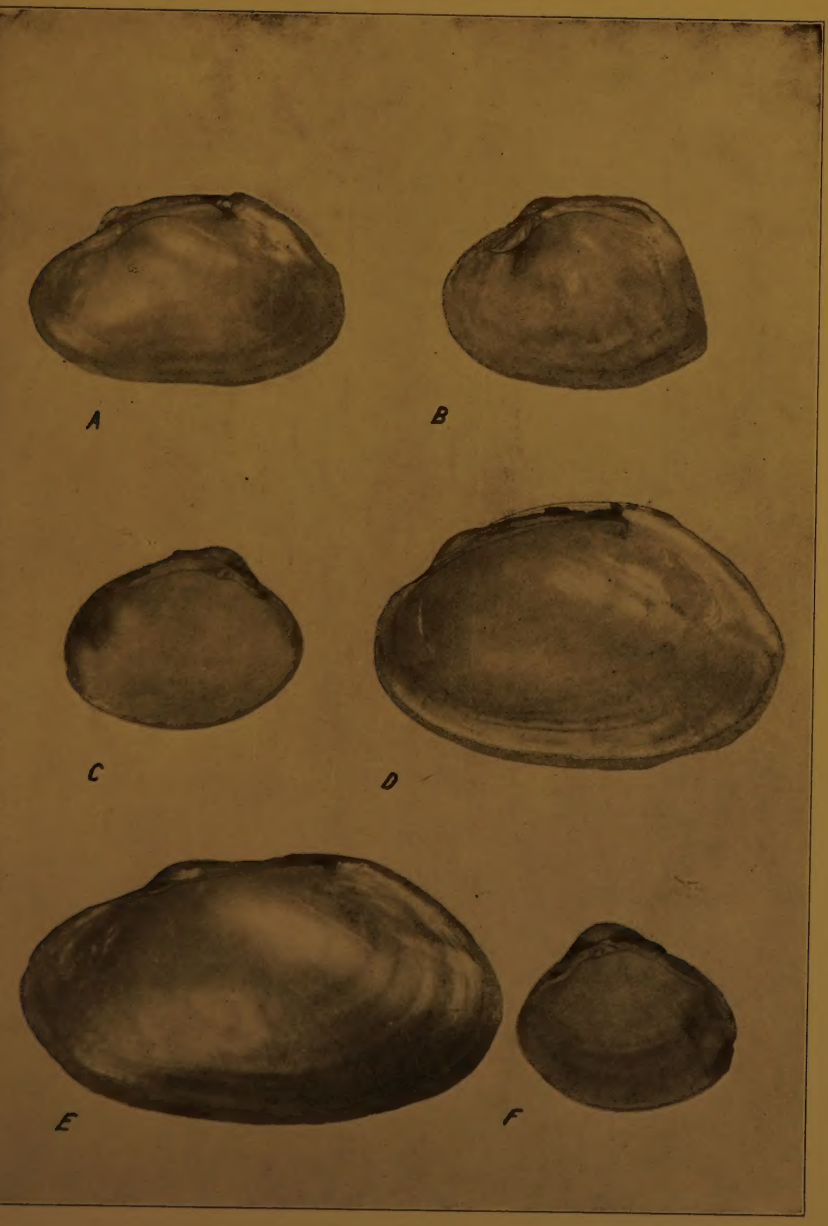
PLATE XXXIII